The

Electrical Review

VOL. C. APRIL 15, 1927. No. 2,577.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT., LONDON," Code, A B C. Telephone No.: Central 7872 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 6d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
Points from Two Speeches	585
Industrial France	586
Fostering Overseas Trade	586
Oil-Driven Generating Stations	586
Electricity Supply at Ashford (*illus.*)	587
Power Transformer Operation, by D. W. McJannet (*illus.*)	589
Wireless Telegraph Communication, by Lieut.-Col. Chetwode Crawley	592
Arbitration Law Reform	595
Business and Industrial Notes	596
Lighting and Power Notes	600
Tramway and Railway Notes	602
Telegraph and Telephone Notes	602
Radio Notes	603
Contract Information	603
Forthcoming Events	605
Notes	605
Institution Notes	606
Our Personal Column	607
Financial Section—	
New Companies Registered	607
Financial Section—*continued.*	
Official Returns of Electrical Companies	608
City Notes	608
Stocks and Shares	611
French Industrial Progress	613
A Railway Signalling School (*illus.*)	614
New Electrical Devices, Fittings and Plant (*illus.*)	615
Electricity in Warships, by W. McClelland (*illus.*) (*concluded*)	616
Electrical Development in Spain	618
Indian Electrical Notes	619
Parliamentary News	619
Correspondence—	
Testing Three-wire A.C. Networks	621
Municipalities and Foreign Tenders	621
River Water—or Cooling Towers?	621
The Salaries of Engineers	621
Legal	621
Reviews	622
Published Specifications	623
Trade-Mark Applications	623
New Work for Contractors	624

Points from two Speeches.

A FEW weeks ago we were enabled to publish the collective and official view of the B.E.A.M.A. regarding the position of the electrical and allied industries. We need not now recount the various factors which influenced the course of manufacturing and trading operations during a most exceptional year. In the main the influences played havoc with all departments of industry, while some, including certain domestic sections of the electrical trade, derived a measure of advantage. On the whole, everybody felt that the electrical industry had come out of a disastrous period in a gratifying and creditable manner, but most people also felt that, though a bad year had passed away, its consequences would show themselves painfully in the first half year of 1927 as industrial and other concerns issued their reports and profit and loss accounts.

During the past fortnight or so several large electrical manufacturing companies have announced their results, and chairmen have made their explanatory statements, expressed their views on remedies that would bring relief where trouble presses, and ventured forecasts of the future course of trade.

We do not know that the individual statements differ materially from those of the collective organisation where they relate to the situation as a whole, but while an associated report reflects, we suppose, an averaged opinion, discounting extreme views of individual concerns, the separate reports of different companies have a particular interest of their own. In the privacy of the board room as well as in the publicity of an annual meeting with one's shareholders, the experiences of a single business afford the text, and deductions and forecasts are made, and optimism or the reverse is indulged in, according to what has been happening or is expected to happen to that particular undertaking.

The statement made by Mr. P. J. Pybus, as chairman of the English Electric Company, Limited, appeared in our last issue, and it is followed this week by our report of Sir Philip Nash's speech at the annual

meeting of the Metropolitan-Vickers Electrical Co. Both speakers referred to the dislocation of industry due to the year's upheaval, and both had something to say on the subject of competition. Mr. Pybus remarked that manufacturers of heavy electrical plant in their laudable efforts to defeat the foreigner, too often found themselves defeating each other in the race for extra output as a corrective for too low prices. "Competition in the heavy electrical industry had been carried to a point of wastefulness, and it was from the national point of view a costly rivalry." He expressed the hope that the general recognition of that fact would lead to some arrangement being made "by which the destructive internecine competition between all the principal companies engaged in the heavy trade for foreign work could be reduced." An increase of 3 per cent. in selling prices for export would change entirely the result of a year's trading and put the heavy business on to a reasonably sound footing. A large export trade was essential in order that they might fill their works and cover their overhead charges.

Perhaps in due course information may emerge regarding the kind of arrangement that can be made to reduce the internal competition for foreign heavy contracts without playing into the hands of foreign competitors at a time when, as Col. Morcom remarked in his B.E.A.M.A. speech, the electrical export industry is on the eve of an intense struggle with these rival producers who are designing to dominate the world markets.

Mr. Pybus, notwithstanding all the difficulties referred to in his speech, expressed confidence with regard to the future. The world's productive capacity is still largely in excess of demand. As purchasing power improves the overdue increase in demand will, in his opinion, bring a fair world selling price. The company's works, it was stated, were never in better shape. We hope that the long-awaited revival of big plant and equipment orders will bring such advantage to the various English Electric works that the chairman will have a more congenial duty to perform next year.

The speech of Sir Philip Nash was of a more optimistic order. His company is not limited to heavy plant production—it covers a very much wider field offering larger scope. The gratifying profit result which enables a good dividend to be paid and an only slightly reduced output reported for a year like 1926, could hardly justify a mood of depression. The company obtained nearly as much business (value) in the home market in 1926 as in 1925, and it considerably increased its business (in terms of tonnage) obtained in the overseas markets. Export orders received were far in excess of any previous year, but Sir Philip again had to admit that the prices obtained for export work had been barely remunerative. He mentioned with pride, however, that their export successes in such a year as 1926 were an indication of ability to compete with the other great electrical plant manufacturers of the world in overseas markets. With regard to the outlook, the speaker was not enthusiastic in his reference to the home market, because it does not seem likely, in the near future, to provide as much business as he had hoped it would do. Industry generally is not recovering from the effects of the coal strike as quickly as had been anticipated, but conditions may be expected gradually to improve "so that later in the year this market may regain its former activity." We may hope that as the Central Electricity Board is making headway with its work, schemes will speedily be proceeded with which will give the needed stimulus to the heavier section of the industry. Sir Philip Nash finds that the export market offers promise, but competition in the home market is severe.

A point which is troubling all concerns engaged in competitive production is the ever-increasing burden of rates and taxes, and here the foreigner is, of course, at an unfair advantage. This serious matter has been emphasised in Government quarters, and it needs to be driven home more and more among municipalities which are tempted to place plant and other contracts abroad.

Industrial France.

Although her population remains far more agricultural than industrial, France is an outstanding example of the change brought about in Europe by the war. The forced speeding-up of mechanical industry, and the acquisition of further important sources of raw materials, have combined to place France in the front rank of industrial nations.

As a consequence, she is now able to meet her home requirements fully in many directions and still have a surplus for export. In other directions the expansion of exports has been rapid, and a substantial share of the world trade has been obtained. For example, in the electrical material branch, while imports remained practically stationary between 1913 and 1925, the exports rose from 10,200 to 20,200 tons (in 1924 they were 23,600 tons). The balance in France's favour thus rose from 2,600 tons in 1913 to 12,400 tons in 1925.

The home demand has been stimulated by generous State aid, both in the electrification of rural districts and in water-power and other development. The report by Mr. J. R. Cahill, reviewed in this issue, attributes partly to this strong home demand the fall in exports from 23,600 tons in 1924 to 20,200 tons in 1925.

It would appear that while their home market makes French manufacturers to a great extent independent of the export trade, it also enables them to compete on better terms in foreign markets. It is to be hoped that our own home demand will so grow in the near future as to put our firms in the same enviable position.

Fostering Overseas Trade.

While it may be admitted that the present State organisation could profitably be cut down, some discrimination must be exercised in the application of the axe. The mere saving of expenditure does not always mean a gain to the country, and one of the last departments which should be attacked at the present time is that charged with the care of Overseas Trade. It was, therefore, a rather thoughtless suggestion which was made in the House of Lords recently, that the D.O.T. should be abolished as a measure of economy, and Mr. Dunwoody, secretary of the Association of British Chambers of Commerce, has our support in his condemnation of the proposal. If any alteration is desirable it is in the direction of improving and strengthening the department—not getting rid of it. We should be glad to see it occupying as important a position here as the United States Department of Commerce does in relation to that country's foreign trade. A recent statement averred that this organisation was responsible for increasing America's overseas trade in 1925, by £110,000,000; the annual cost of the organisation is £600,000. A department which gives such results is worth keeping, but it must be given sufficient scope, and not just tolerated.

Oil-driven Generating Stations.

The question whether very large power stations at a distance from their load can compete on an economic basis with power stations of small or moderate size, situated close to the consumers' premises, is one which cannot be answered offhand—the Weir Report notwithstanding.

On the following pages we give a description of the 1,200-kW, oil-driven plant at Ashford, the adoption of which was sanctioned by the Electricity Commissioners in view of the fact that the cost of energy in bulk from an economical generating station less than 20 miles away would have been far more than that of the locally generated supply, owing, we believe, to the capital charges on the transmission line.

We do not suggest that this particular instance affords a solution to the general problem, but it certainly indicates that the day of the small power station is not over; and if, as is probable, cheap British oil becomes available from the low-temperature distillation of coal, its position will be greatly strengthened.

Electricity Supply at Ashford.

A recently inaugurated municipal electricity supply undertaking, with an alternating-current 1,200-kW oil-driven generating station, to which 500 consumers were connected in four months, resulting in a maximum load of 250 kW.

ASHFORD, an important market town situated in the Weald of Kent, is the centre of an agricultural district with a population of 15,000.

Many years ago the Urban District Council obtained a Provisional Order to supply electricity, but nothing was done, and the Order, after being transferred to a company, lapsed without any scheme being put in hand. In 1923, public demand induced the Council to take up the matter again, and a firm of consulting engineers was engaged to submit a report. At this stage the question of obtaining a bulk supply from a neighbouring town was considered, but, after negotiations, the Electricity Commission notified the Ashford Council that it would be advisable for it to install its own plant. As a result, a small direct-current scheme was put forward, principally for lighting. The Council, however, decided that the scheme was of insufficient capacity to supply electricity for industrial purposes, and the matter again lapsed until early in 1924, when the Council advertised for an engineer to prepare a scheme and, subject to its approval, to become the Council's electrical engineer. As a result, Mr. H. Wilson (distribution engineer at Paisley, and previously of Croydon and Maidstone) was appointed, and from July, 1924, the town's electricity scheme has been controlled by a small committee of the Council, in conjunction with its engineer. The Special Order, as finally sanctioned by Parliament in December, 1925, included the urban and West Ashford rural districts, and, the bolder policy of catering for the future rather than the present having prevailed, it was decided to generate 3-phase alternating current at 6,600 volts, 50 periods, and to distribute from transformers at 400 and 230 volts on a 3-phase, 4-wire system.

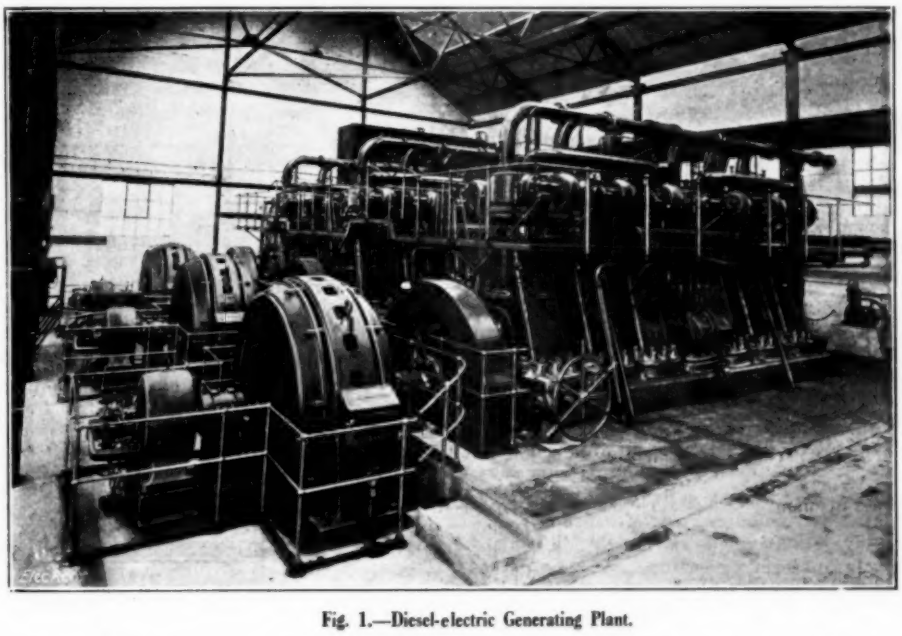


Fig. 1.—Diesel-electric Generating Plant.

The choice of a prime mover being in favour of crude-oil solid-injection engines of the Diesel type, three 400-kW sets were finally decided on, and armoured cables were laid direct in the ground and fed from transformer kiosks having a comparatively small radius of approximately 500 yd., *i.e.*, 1,000 yd. between kiosks; as a result, no cable of more than 0.1 sq. in. conductor section has been installed.

The site of the generating station consists of 2½ acres between the main Southern Railway line and the River Stour, on which work was commenced in February, 1926. A 4-in. pipe line 130 yd. in length conveys fuel oil from a previously existing siding to a motor-driven pump in the engine room, delivering at the rate of 600 g.p.h. through an oil meter into either of two storage tanks of a combined capacity of 200 tons; the steel-plate tanks, supplied by Messrs. Braithwaite, Ltd., are enclosed by a brick wall 4 ft. 6 in. high, and the same pump can be used to convey oil from them to an 800-gallon tank situated in the engine room, from which the oil passes, either direct or through a De Laval purifier, into a second 800-gallon tank, and thence to the engine service tanks. In any case, a centrifugal purifier was required to deal with the lubricating oil, and a 250-g.p.h. set was installed; all the fuel oil used is also passed through it.

From the engine service tanks of 100-gallon capacity, fitted with water-heated coils, the oil passes to three Ruston & Hornsby 600-b.h.p. solid-injection oil engines (fig. 1) of the six-cylinder open type, each developing 600 b.h.p. at 250 r.p.m.; it is injected on the Ruston mechanical system, and a distributor is used in conjunction with two pumps so connected that they are controlled by one governor.

Directly coupled with the engines are three 400-kW alternators, supplied by the English Electric Co., each having its own exciter on a shaft extension. The "English Electric" e.h.p. truck-type switchboard (fig. 2) has eight panels: three for the alternators; three for outgoing feeders; one for a station transformer, which also supplies the low-voltage network; and one for splitting the busbars so that access may be obtained to any part without depriving the town of its supply.

The cooling-water system consists of a concrete pond

(fig. 3) of an area of 900 sq. yd. and a depth of 2 ft.; two motor-driven Gwynne centrifugal pumps deliver water to an overhead tank, and thence by means of a 4-in. ring main to the three engines; each of the pumps is capable of delivering 18,000 g.p.h. to the tank, which figure corresponds to 10 gallons per b.h.p.-hour with the three engines on full load. Arrangements have been made for pumping water direct into the ring main if it should be necessary to empty the overhead tank, and a 3-in. town main runs to a float valve in the overhead tank to form an automatic

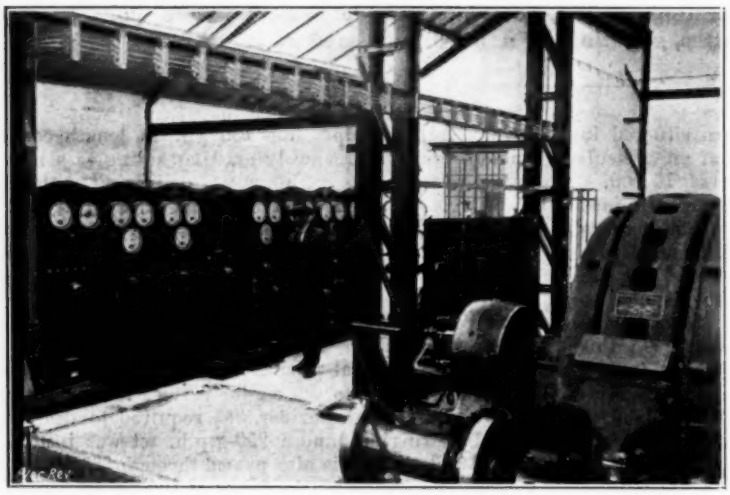


Fig. 2.—Truck-type 6,600-V Switchboard.

stand-by supply and for use when it is necessary to empty the pond for cleaning purposes.

A hand-operated 10-ton Morris travelling crane spans the engine room, which is a steel structure with brick filling and a glass and asbestos slate roof, in which no combustible material has been used.

Two six-roomed houses have been provided for the occupation of the engine-room and mains foremen, and are, of course, "all-electric," except the hot-water supply, which is provided by a boiler through which the exhaust from any, or all, of the three engines may be passed, or by-passed, by means of dampers. The boiler also supplies hot water for heating the fuel and lubricating oil before centrifuging, and gives an ample supply for all purposes. Compressed air is only required for starting the engines, and four bottles are charged either by a motor-driven compressor or by a paraffin engine-driven compressor.

Offices and stores are situated on a corner of the site, and telephone communication has been provided.

The distribution system consists of a 6,600-V ring main near the outer circumference of the town, approximately 7,000 yards in length, on which are situated six transforming points, consisting of sheet-steel cubicles supplied by the New Switchgear Construction Co., Ltd., each having an ultimate capacity of 250 kW and a spare e.h.p. way for future extension. The e.h.p. ring main is of 0.1 sq. in. conductor section, and a branch cable of the same size is taken into the Southern Railway Co.'s carriage works to feed a 500-kW Hewittic mercury rectifier which the Company has installed to operate in conjunction with its own direct-current plant.

The transformer kiosks have been placed in close proximity to possible power users in the town, so that such customers can be supplied by independent cables direct from the kiosks, the transformers at the same time feeding into the low-voltage network, which is made up of 4-core, 0.1-sq. in. paper-insulated, lead-sheathed, steel-tape-armoured cable laid direct in the ground under the footpaths. All high-voltage cables are wire armoured, so that they are readily distinguishable with a view to preventing accident. The neutral conductor of all the l.p. cables is of a cross section equal to that of the phase conductors, as it is anticipated that considerable out-of-balance currents may have to be dealt with in connection with probable domestic loads. No underground disconnecting boxes have been used, but distribution pillars (supplied by Messrs. Lucy & Co., of Oxford) have been installed at convenient points between the kiosks.

Provision for half-night street lighting has been made throughout the whole system, and a separate conductor has been provided for this purpose. All-night lighting in the main thoroughfares has been provided for by a second conductor, and all street lighting will be controlled from the works through a relay system where necessary. The half-night lighting conductor has been carried into such premises as may require a supply for sign illumination, and a special rate of £1 per 30-watt lamp per annum is quoted for this purpose.

Cast-lead service boxes with wiped joints have been used throughout the whole system, and careful attention has been given to armour bonding. The whole of the cable has been supplied by Callender's Cable and Construction Co., Ltd., and was laid by direct labour under the supervision of the Council's engineer.

The supply became available on November 1st, 1926, and by the end of February, 1927, approximately 500 customers had been connected, resulting in a maximum load of 250 kW. At an early date a supply is to be given to two flour mills and to the Southern Railway Co.'s carriage works, so that quite a good day load is anticipated. The Council is quoting very low rates to large consumers and, as there is a good deal of vacant land with

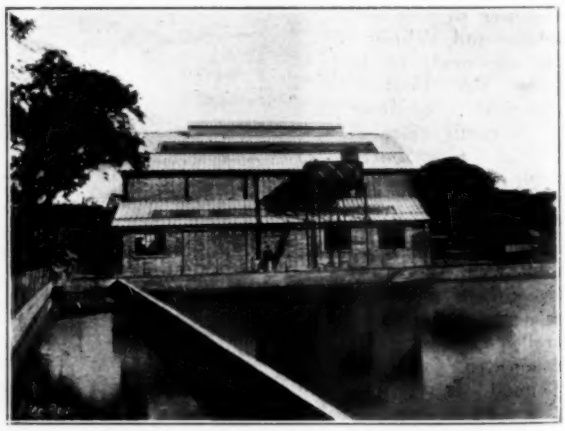


Fig. 3.—Power Station and Cooling Pond.

excellent transport facilities, it is hoped that cheap electricity will attract new industries to the district.

The annual capital charges per kW of peak load which the station can deal with, including stand-by plant, and including land and building, but excluding distribution, amount to £4. Fuel oil consumption per kWh generated will probably come out at 0.8 lb., costing 0.36d., and lubricating oil at 0.025d.; wages at 0.12d., repairs and maintenance at 0.06d., making a total running cost of 0.565d.

It is estimated that in the summer of 1929 an extension will be required to meet the autumn load of that year, and an interesting problem will then arise as to the form which the extension should take, and the alternative question of bulk supply. The figures to make bulk supply an economical proposition will probably be in the neighbourhood of £3 10s. per kW and 0.4d. per kWh.

Power Transformer Operation.

The author describes and compares the various systems at present in use, or available for use, for the protection of electrical apparatus in their application specifically to power transformers, including two recent introductions by the British Thomson-Houston Co., Ltd., and Messrs. Johnson & Phillips, Ltd.

By D. W. McJANNET.

IT is intended in this article to summarise the various forms of protection as applied to static power transformers. Many excellent papers have been presented on the general subject of protection, but very few have dealt with the subject as applied specifically to this important apparatus.

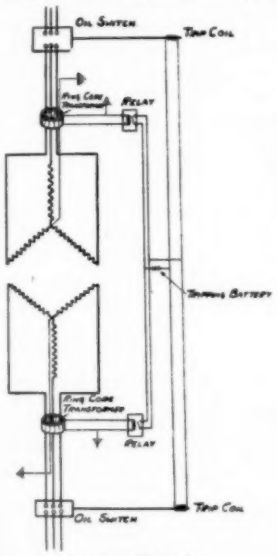


Fig. 1.—Core-Balancing Protection.

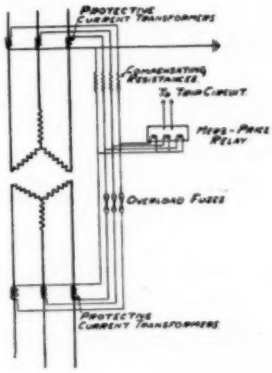


Fig. 2.—M.P. System, Star-Star Transformer.

The subject of protection from mechanical damage due to short-circuiting is one that demands attention in the design of the transformer. This usually takes the form of special bracing of the winding in a radial direction, and automatic or hand-operated axial coil supports are provided to take up any shrinkage which may occur in an axial direction. Radial coil supports are not necessary, and are generally regarded as being a source of danger rather than safety. As a further precaution, the reactance should be kept as high as possible, in order to keep down the value of the short-circuit current, the actual value depending on the output of the transformer, its position on the system, and the reactance of the rest of the circuit. The following table shows the average values of reactance usually put forward for standard designs of apparatus, but these can be increased or decreased slightly without materially varying the other values of the transformer.

For small transformers on overhead lines overload protection is usually carried out by means of fuses, either of the expulsion type or the more simple form consisting of fuse wire connected across horn breaks. For protection against high-frequency impulses it is usual to insert an air-core choke coil. The type of choke coil usually supplied often fails to smooth out the front of the wave before it reaches the transformer winding, and in this connection it is usual to reinforce the insulation between the turns for about 5 per cent. of the winding; but where the transformer is to be installed in a climate where atmospheric disturbances are frequent and severe, it is then sometimes necessary to insulate all the turns on the primary side for full-line pressure between the turns. In connection with the protection of transformers connected to overhead lines, a good deal of work has been carried out in Germany and America on choke coils and condensers used in conjunction with resistances. A particularly interesting paper on this subject by Mr. S. A. Stigant will be found in the J.I.E. *Journal* for June, 1922. This deals very fully with wave shape and the protection of transformer windings against the effect of high-frequency disturbances.

Transformer kVA.		Percentage Reactance. 50 cycles.	40 cycles.	25 cycles.
500	...	4.0	4.5	5.0
1,000	...	5.0	5.5	6.0
1,500	...	5.5	6.0	6.75
2,000	...	6.0	6.5	7.5
3,000	...	6.75	7.0	8.5
4,000	...	7.5	8.0	9.5
6,000	...	8.5	9.0	10.5
10,000	...	10.0	10.5	12.0

It is very desirable that there should be no possibility of the l.p. side of a transformer becoming charged at a higher pressure than normal, due to the breakdown of the insulation between the h.p. and l.p. windings.

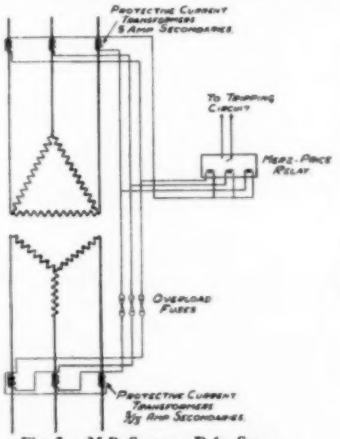


Fig. 3.—M.P. System, Delta-Star Transformer.

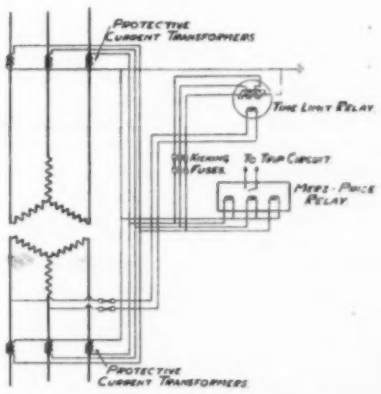


Fig. 4.—M.P. Protection with Kicking Fuses and Relay.

An early form of protection against this type of fault was the introduction of a split copper-sheath between the two windings, but insulated from them, the ends of the sheath being earthed. It was found, however, that this earth shield was in the nature of an added danger rather than a protection, as the inclusion of such a

shield tended to weaken the insulation between the windings, and unless special care was taken, the two ends of the shield came into contact and formed a short-circuited turn. Another disadvantage, which is probably not so well known, is the blanketing effect which this shield has on the inside winding. An earthing device is now more commonly employed connected to the l.p. neutral point, so that should the pressure rise in the secondary winding, a paper or other insulating disk

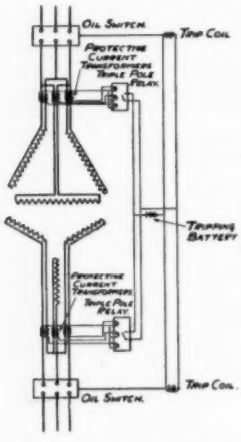


Fig. 5.—Self-Balancing Protection.

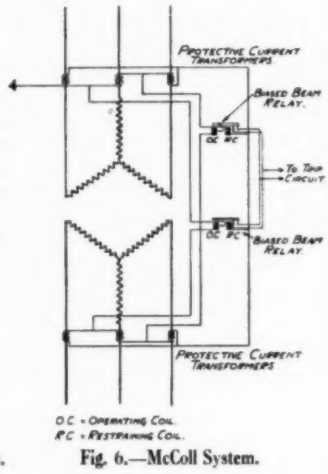


Fig. 6.—McColl System.

is punctured, thus connecting the l.p. neutral to earth. In the case of single-phase transformers, the mid-point of the secondary can be brought out and earthed through the device. Possibly the best protection from this type of fault is the earthing of the neutral direct, especially in the case of isolated units. Where transformers situated at some distance from one another are operating in parallel on both the h.p. and l.p. sides, it would only be permissible to earth one neutral positively on account of the possible circulation of third-harmonic currents. The other neutral point could conveniently be earthed through a suitable device.

For small transformer units in isolated positions, plain overload protection only is usually employed. This can be improved upon by the inclusion of leakage protection and time-limit fuses on the overload trips. A.c. tripping is usually employed, the trip coils being connected direct to the secondaries of the current transformers. Where two or more transformers are operating in parallel, plain overload protection should never be employed. If all the transformers are operating at full-load and one develops a fault which trips it out of commission, the remaining transformers will then be sharing the load of the faulty transformer, which may be sufficient to operate their trip coils, thus shutting down the whole bank of transformers.

Another simple form of protection is that provided by the core-balancing system, although this method is limited in its application and gives protection against earth faults only. The diagram in fig. 1 shows a three-phase star/star transformer protected by this method. The main leads on each side are taken through the opening of a ring transformer, the secondary of which is connected to a relay operating the tripping circuit. In order that the transformer shall not be switched out by a distributor fault, the earth connection from the neutral point should also be taken through the core of the protective current transformer. When this is done, current will flow in one direction only, in the event of an earth fault on the transformer, thus disturbing the balance and thereby operating the relay. The relays will operate with a fault on either the h.p. or l.p. windings. It is not, however, always permissible to earth the h.p. neutral, or that may not be available, but where circumstances permit, this system can very easily be installed on existing plant without any alteration to the transformer connections.

The Merz-Price circulating-current system is probably the most popular of all the protective systems at present in use. It gives protection against faults to earth and between phases, and is entirely discriminating. The principle of the system depends on the equality of currents flowing in and out of a sound circuit. Where a transformer is introduced, the currents in the primary and secondary are equal in a mathematical sense, but they can be directly compared by suitably arranging the ratio of the primary and secondary protective current transformers. The connections for the application to a star/star connected transformer are shown in fig. 2 and for a delta/star transformer in fig. 3. It will be noticed that in the case of the delta/star-connected transformer the current transformer secondaries are connected in delta on the star side and star on the delta side. This is necessary to compensate for the phase displacements between the line currents on the primary and secondary sides, and, in addition, it is necessary to make the ratio of the current transformers on the delta side X to $5\sqrt{3}$, so as to obtain 5 A in the secondary leads at full load. It is often impossible to take tappings off the secondary leads at points of equal potential, and in such cases compensating resistances can be inserted, enabling the tappings to the relay to be made at convenient points. By the insertion of suitable fuses in the secondary leads, overload protection can also be obtained with this system. In the case of a heavy overload these fuses will blow, causing the relay to operate. Where adjusting tappings are fitted on the main transformer, it is necessary to make provision for keeping the current-transformer secondaries balanced under normal conditions, whatever tappings may be used on the main transformer. This could be done by means of compensating resistances, or suitable tappings could be provided on the current-transformer secondaries, so that, should the h.p. current increase, due to working on a lower-voltage tapping, the current-transformer secondary currents would still be 5 A at full load under working conditions.

When switching in transformers there is often a heavy rush of current in the primary which does not appear in the secondary, and there is therefore a danger of this gear operating when switching on, with no fault existing. To prevent this happening, the relays are shunted by so-called "kicking fuses," usually set to "blow" at 75 per cent. overload. These cause the relay settings to be coarse, and it is advisable to provide some arrangement whereby the fuses are only in circuit during the switching-in period, and are automatically

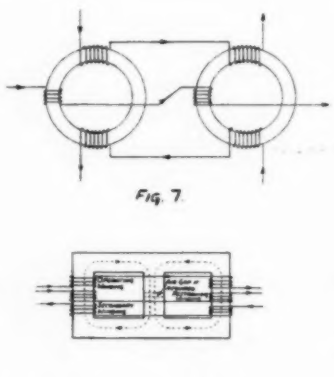


Fig. 7

Figs. 7 and 8.—B.T.-H. Biasing Transformers.

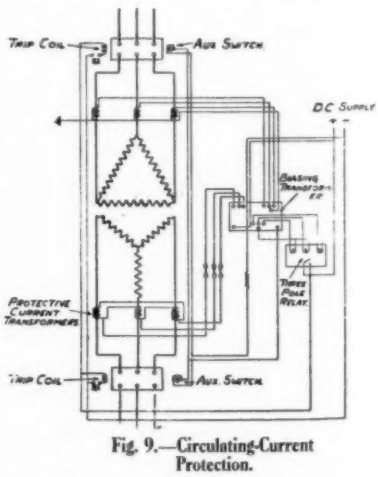


Fig. 9.—Circulating-Current Protection.

removed when the circuit breaker has been closed for a predetermined time. This can be carried out by means of an additional relay, as shown in fig. 4. When the oil switch is closed, this device comes into operation, and the plunger commences to rise against an air dashpot. At the end of a fixed time-setting the plunger reaches the point at which the contacts, dipping in mercury cups, are raised, thus cutting out the fuses. When the switch is tripped, the relay resets itself and the fuses are again in circuit. The only disadvantage of the switching-on protection is that the coil is always on load, and should it burn out the fuses would still be in circuit without the switch tripping. The Merz-Price system can be easily installed on existing transformer plant without making any alterations to the transformers.

Many of the disadvantages of the Merz-Price system are overcome in the self-balancing system, which provides against short-circuits between phases or earth faults, but not against short-circuits between the turns. The system is based on the comparison of currents entering and leaving the windings, separate protection being provided for both h.p. and l.p. sides. Current transformers are required for each winding to be protected, and these each have two primary windings in series with the incoming and outgoing leads to the transformer windings. The secondaries of the current transformers are connected to relay elements operating the tripping circuits, the connections for a delta/star transformer being as shown in fig. 5. Under normal conditions the currents in the two

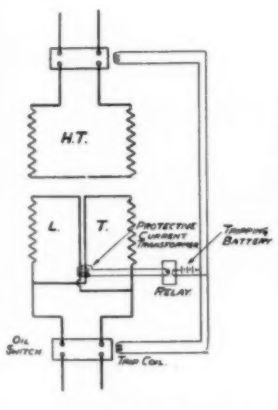


Fig. 10.—J. & P. System for Between-turn Faults.

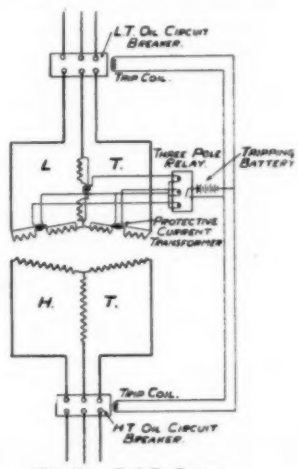


Fig. 11.—J. & P. System. Three-phase.

primaries are equal and opposite, so that no flux is produced in the core of the current transformers. When a fault occurs, current will enter through one primary winding and pass to earth, or another phase, without returning through the other primary winding, thus producing a flux in the current-transformer core, and causing operation of the relay and oil switch. The system is very sensitive, and under normal conditions no p.d. exists between the different parts of the secondary winding, thus minimising the risk of accidental operation. This risk is further reduced by the absence of pilot wires between the current transformer secondaries. As the h.p. and l.p. sides are treated independently, the system is proof against switching-on current rushes, and the presence of tappings on the main transformer does not introduce complications. It is a very simple system for all cases involving phase relationships or voltage variations. As the current transformers are inherently self-balanced, there is no danger of operation on heavy overloads due to unbalancing in the current transformers. It is difficult to install this gear on existing plants, as both ends of each phase of the power transformer must be available, but for new transformers it presents no difficulties. If the protective gear is ordered with the plant, the current transformers can be accommodated in the tank and the connections suitably arranged.

The McColl circulating-current method of protection is really an improvement on the Merz-Price system. The relays used are of the biased-beam type, one coil having a restraining effect. There are two main reasons for the instability of the Merz-Price system, namely, the faulty choice of equipotential points and the possibility of the current transformers developing different characteristics when the induction density reaches a high value; and as the unbalancing effect cannot be accurately calculated, it is necessary to make the relay-setting high to ensure stability. The McColl system, by the use of the biased relays, overcomes this objection. The restraining coil carries the main current of the system, the other coil being connected to equipotential points. If a 10 per cent. bias is required, it is necessary to wind the restraining coil with approximately 10 per cent. of the turns used for the operating coil. The relay will then be held in the off position until the unbalanced current flowing through the operating coil has a value equal to 10 per cent. of the current traversing the restraining coil. At this value the ampere turns of the two coils will balance one another. With such an arrangement it is possible to give a definite guarantee of stability, as ample latitude for unbalancing may be allowed. Fig. 6 shows the arrangement applied to a star/star transformer, two relays only being necessary. With delta/star connection the protective current transformers have to be connected in delta on the star side, the secondaries being arranged for $5/\sqrt{3}$ A as in the Merz-Price protection. The system has much to recommend it, as it is quite sensitive without the relays being in any way delicate. They will therefore stand up to any rough handling which they are likely to receive. As regards its installation, the system offers no difficulties beyond those of the ordinary Merz-Price equipment.

A further means of providing bias has been developed by the British Thomson-Houston Co., Ltd. This does not involve the use of special relays, but depends for its action on a special biasing transformer. A simple method of restraining the relay from operation is provided if, instead of introducing additional forces in opposition to the operating effect, a reduction in the magnitude of the latter be brought about. What is required is some intermediate device connecting the operating apparatus and the relay, capable of transmitting to the latter such an amount of the available energy as may be appropriate to the circumstances under which the apparatus is functioning. To meet these conditions a specially designed transformer has been produced. It is provided with a primary or operating winding, a secondary winding, and a further winding known as a restraining winding. This is not inductively related to the operating and secondary windings, but it excites a magnetic circuit, a portion of which is common to that with which the other windings are linked. Such an arrangement may consist of two ring cores, each provided with similar operating and secondary windings connected in series as in fig. 7. A third coil present on each core, but in one case reversed, will, if excited, have the following effect. Such e.m.f.'s as may be induced in each secondary by this third coil will not appear in the complete secondary circuit, as they will be in opposition; nevertheless, the magnetic circuits of each transformer will be excited. If such proportions be chosen that currents flowing in the restraining winding give rise to saturation of the iron, this will effect the secondary current corresponding to any given operating current. Excitation of the restraining winding is capable of increasing the reluctance of the magnetic circuit to such an extent as will necessitate a much greater operating current in order to deliver the required secondary energy. If, therefore, the operating winding be connected in place of the relay, this being connected to the secondary winding, the desired effect is obtained. A better type of construction is shown in fig. 8. Divided restraining windings are used which give a more efficient restraint, and

these windings will give rise to a saturating flux passing through the centre, as shown by the dotted lines. Former-wound coils may be used in this apparatus, and a further advantage is that an air gap may be used in the restraining magnetic circuit without reducing the unrestrained permeability of that associated with the other windings. A d.c. restraint can be incorporated which can be applied, when switching on a transformer, to prevent the operation of the relays due to switching-on current rushes. Fig. 9 shows a three-phase, delta/star transformer protected by the circulating-current system embodying biasing transformers. In this case a ratio-correcting element is included so that transformers with standard 5-A secondaries may be used for both sides of the transformer. Further d.c. restraint is provided to prevent operation of the relays during switching-on periods.

A protective system for faults between turns has been patented, and, as its title denotes, has for its object the switching-out of a transformer in the initial stage of the development of a short-circuit between the turns on either the h.p. or l.p. winding. This apparatus, which is being manufactured by Messrs. Johnson & Phillips, Ltd., under licence, consists of one or more ring-type current transformers and a single- or three-pole relay, depending on whether a single- or three-phase transformer has to be protected. One winding of the power transformer, either h.p. or l.p., is split into two halves, which are connected in parallel, the parallel connections being taken in through the centre of a ring core upon which the secondary winding is arranged, the latter being connected to a sensitive relay. The two halves of the winding are arranged so that under normal conditions the impedance of each half is the same, hence the currents flowing in opposite directions through the ring-type transformer will be equal and will not give rise to any flux in the core of the current transformer. A short circuit between the turns of either the h.p. or l.p. winding will have the effect of altering the impedance of the two halves so that the currents flowing through the ring-core transformer will no longer be the same, hence a flux will be produced in the current transformer core causing operation of the relay. This method cannot be applied to existing plant without rewinding either the h.p. or l.p. winding, but it can easily be applied to new transformers without involving extra cost in manufacture. Especially is this the case with transformers wherein the l.p. current is fairly high, as the winding would, in any case, be split into two coils connected in parallel. On single-phase transformers the application is even more simple as the two limbs can be connected in parallel and only one current transformer is needed. The current transformers consist of ring cores with single bar conductors passing through the cores in a similar manner to the arrangement adopted for self-balancing protection. It will be realised that this system will only confine the damage due to a short circuit between the turns to the faulty turns. With other systems of protection the destructive effect due to a short circuit between the turns usually goes on until it develops into an earth fault, before the relays operate. This often involves the complete destruction of the winding and its repair is a fairly lengthy and costly business. With the system under consideration the transformer would be tripped out in the initial stages of the fault, and would considerably reduce both the cost and time required for repairs. The connections for a three-phase star-star transformer are shown in fig. 11, and for a single-phase transformer in fig. 10.

For further information on this subject the following works can be consulted with advantage:—

"A.C. Circuit Protection," by R. Bannister and G. E. Gittins; *Mining Electrical Engineer*; Vol. III, 1922.

"Automatic Protective Devices for A.C. Systems," by A. E. McColl: I.E.E. *Journal*: Vol. 58, July, 1920.

"Design of Apparatus for the Protection of A.C. Systems," by A. S. Fitzgerald: I.E.E. *Journal*; Vol. 62, July, 1924.

"Automatic Protective Switchgear for A.C. Systems," by E. B. Wedmore; I.E.E. *Journal*: Vol. 53, 1915.

"Design of Electrical Plant, Control Gear and Connections for Protection against Shock, Fire, and Fault," by H. W. Clothier; I.E.E. *Journal*; Vol. 63, 1925.

"The Influence of Condenser and Choke Coil Protective Devices on Travelling Electric Waves," by S. A. Stigant; I.E.E. *Journal*; Vol. 32, June, 1922.

"J. & P. Transformer Book," by S. A. Stigant and H. M. Lacey; 1924.

Wireless Telegraph Communication.

A review of the present position of maritime safety services, commercial communication, and point-to-point telegraphy in view of the proposed modified requirements and regulations to be discussed at the forthcoming International Conference in the United States next Autumn.

By Lieut.-Col. CHETWODE CRAWLEY, M.I.E.E.

THE International Conference of 1912 laid down regulations governing the installation and operation of wireless telegraph apparatus in ships, and it has been announced that the next International Conference will be held in October next at Washington, U.S.A., for the purpose of framing a new Convention.

The 1912 Convention dealt only with ships' communications, as there were then practically no wireless services between fixed stations, but the coming Conference will deal with all aspects of the problem, *viz.*, the communications of mobile stations, fixed stations, amateur experimental stations, and broadcasting. It may be of interest therefore, to take stock now of the present position of our commercial wireless communications, and briefly to indicate the main points which will come up for consideration at the International Conference.

(1) Ships' Safety Services.

The primary use of wireless telegraphy for shipping purposes is to lessen the chances of disaster at sea, and it is this aspect alone which we shall consider in this article.

Ships' Sets.—In this country it was laid down by an Act of Parliament in 1919, that every sea-going British ship registered in the United Kingdom, being a passenger steamer or a ship of 1,600 tons gross tonnage or upwards, must be provided with a wireless telegraph installation, and must maintain specified watches on the 600-metre wave, on a spark or interrupted-continuous-wave type of installation. The installation must be capable of transmitting clearly perceptible signals from ship to ship over a range of at least 100 nautical miles by day, and, in addition, emergency arrangements must be made for signalling

for six hours continuously, over a range of at least 80 miles for large ships and 50 miles for small ships, using a source of energy that is independent of the main power of the ship.

In addition to the ships' sets, it was laid down by the Board of Trade in 1925 that all our foreign-going passenger steamers which carry more than 10 lifeboats must have at least one of them fitted with wireless telegraphy, and if there are more than 15, or more than 20 lifeboats, at least one or two, respectively, must be motor boats fitted with wireless. Transmission must be on the 600-metre spark wave, giving a minimum metre-ampere figure of 15, and the normal receiver must be a valve type, with a crystal set as an alternative.

It is obvious that a method of rating stations by taking the product of maximum aerial current and the maximum height of the aerial, is more practical than rating them by range of working, which depends on so many circumstances. This is a matter which will be considered at the International Conference.

Operators.—The number of operators to be carried and their periods of watch, were laid down for different classes of ships. In ships which carry 200 persons or more, a qualified operator must always be on watch at sea. In ships which carry between 50 and 200 persons, a qualified operator must be on watch at scheduled times amounting to eight hours a day, and watchers who need only be able to recognise the distress (S.O.S.) and safety (T.T.T.) signals, must be on watch at all other times. In ships which carry less than 50 persons, a qualified operator must be on watch at scheduled times amounting to eight hours a day, and no watch need be kept outside these periods. Operators, who must be British-born of British parents, must be in possession of the Postmaster-General's certificate of proficiency.

Candidates for the examination for this certificate are trained at some two dozen privately owned schools. A watcher has also to pass a Post Office examination, but in his case the only qualification required is ability to recognise the distress and safety signals.

At present there are about 4,000 operators and 1,000 watchers serving in 3,150 British ships which are compulsorily fitted with wireless telegraphy.

The qualifications required for the various classes of operators' certificates and the regulations for having internationally scheduled times of watch, will come up for revision at the International Conference.

Inspection depôts are established by the Post Office at the prineipal ports for the inspection of ships' installations, to ensure that they conform with the regulations and are being properly maintained by the operators. About 3,500 inspections are carried out annually.

The Alarm Signal.—Automatic receiving apparatus has recently been designed by the Marconi Company and the Radio Communication Company to register the reception of an alarm signal by ringing a bell to call the operator to the instruments. Such apparatus, if found up to the standard required by the Government, will allow of all ships which are fitted with this apparatus being on constant watch for distress signals, without the necessity of employing watchers. The signal which has been selected in this country as an alarm signal for the purpose of working the automatic apparatus consists of a series of 12 dashes sent in one minute, the duration of each dash being 4 seconds, and the duration of each space one second. It is intended that this signal should be sent before the usual S.O.S. distress signal. There are no international regulations governing an alarm signal of this nature, and the matter is one which will come up for discussion at the International Conference.

All large passenger ships are now fitted with continuous-wave installations for long-range traffic, in addition to the spark sets which are compulsorily fitted for safety purposes, but it is laid down that all British ships, no matter how fitted, must stand by during their hours of watch to receive distress signals on the 600-metre wave on their spark receivers, whenever their continuous-wave sets are not in use, and in any case must do so for three minutes every half hour, at a quarter past and a quarter to each hour, G.M.T. This arrangement will be considered at the International Conference.

A great deal of ordinary traffic, in fact over 70 per cent., is still conducted on the 600-metre wave with the spark installations, as the great majority of ships are not fitted with continuous-wave installations, and as most of the coast stations throughout the world stand by on the 600-metre wave so as to be ready for distress calls. In order to reduce the present interference on the 600-metre wave, it is expected that regulations will be included in the International Convention by which much of this spark traffic will be transferred to other waves.

Directional Receivers in Ships.—Directional receiving apparatus, by which a bearing of a wireless transmitting station or ship can be taken, is now installed in about 9 per cent. of the British ships compulsorily fitted with wireless, including practically all our large passenger steamers, and as its great utility becomes more generally recognised, the number of ships fitted will no doubt increase rapidly. The sets used are fitted by the Marconi Company, the Radio Communication Company, and Siemens Brothers.

In the Marconi Company's sets, the aerial consists of two vertical loops in planes at right angles to one another, and in the receiving apparatus a coil is rotated, by which the strength of the received signals is varied. The direction from which the signals come is determined by the position of the coil when the signals are heard weakest. In the Radio Communication Company's set, the aerial is similar, and the direction from which the signals come is determined by rotating the loops until the strength of the signals is unaffected by reversing, with a switch, the mutual connections of the loops. In the Siemens Brothers' set, a single loop aerial is rotated, and the direction from which the signals come is determined by the position of the loop when the signals are heard weakest.

Recently, Mr. Watson Watt and Mr. Herd, working for the Radio Research Board, designed a form of directional receiver, which, when further developed, may prove of great value to ships. It is the nearest approach to a wireless compass yet produced, as it is a direct-reading instrument which can be used by the navigator on the bridge. This apparatus is still, however, in the experimental stage, and it is generally agreed that the directional instruments now on the market are best operated by a skilled wireless telegraphist.

The difficulties that ships labour under, compared with coast stations, are that errors may be introduced by changing the positions of guys, derricks, &c., that there are fewer opportunities of taking check bearings on known fixed wireless stations, and that errors may arise due to the necessity of having to refer the observations taken to the position of the ship's head as shown by the compass at the moment when the observation was taken.

Distress Messages.—In this country, including Ireland, the coast stations are worked by the British Post Office, and "look out" continuously on the 600-metre wave, with the exception of that on the Humber which is closed from 11 p.m. to 8 a.m. These stations are situated at Wick, Cullercoats, The Humber, North Foreland, Niton, Lands End, Fishguard, Seaforth, Port Patrick, Malin Head, and Valentia, so that a ship in distress anywhere near our coasts is in touch with at least one station. The average day range of the coast stations is about 250 miles, though of course much greater ranges are frequently obtained.

When a distress signal is made, all stations and ships which receive it, with the exception of those dealing with it, remain silent until the coast station which is handling the case, signifies that general communications may be resumed. This distress work often entails a complete cessation of commercial signalling

round our coasts for several hours. Nearly 100 distress cases are dealt with annually by our coast stations. The station which deals with a distress call takes all necessary steps to obtain assistance by wireless, telephone and telegraph, informing the Coast Guard, Naval Authorities, Lloyds, and others in special cases. No charge is made for any wireless messages in connection with distress work.

Weather Messages.—Other safety messages for which no charge is made are weather bulletins and gale warnings supplied by the Air Ministry, and navigational warnings supplied by the Admiralty. These are broadcast on the 600-metre wave at scheduled times by our coast stations. Weather reports are also broadcast on a 4,100-metre continuous-wave at scheduled times by the Air Ministry's station in London, and by wireless telephony at scheduled times on a 1,600-metre wave by the B.B.C. station at Daventry. In addition to the broadcast weather services, ships can obtain from any of our coast stations, for a fee of 7s. 6d., weather forecasts from the local meteorological station, or the Meteorological Office. To assist the meteorological authorities in preparing weather forecasts, arrangements are made by which certain ships, when crossing the Atlantic, send reports by wireless.

In the United States and Germany, experiments are now being carried out to apply the principles of telephotography to the broadcasting of weather reports, special receiving apparatus being fitted in the ship. By this means, the navigating officer, instead of drawing his own synoptic charts from the data received by wireless, will have the charts drawn for him by the receiving apparatus.

Directional Receivers on Shore.—Directional receiving apparatus of the fixed double-loop type is fitted at the stations at Cullercoats, Niton, and Wick, and bearings are given on the 600-metre wave to any ship on demand at a charge of 5s. per bearing; for the same fee, any coast stations will send signals to enable a ship fitted with directional receiving apparatus to obtain a bearing on the station. There is also a Post Office directional station on the 600-metre wave for ships at Flamborough, and a Naval station at The Lizard which gives bearings to merchant ships on the 800-metre wave for the usual 5s. fee. A new coast station which will be used for ordinary work and direction-giving purposes on the 600-metre wave, is being erected by the Post Office at Mablethorpe. This will replace the present Humber station and the direction-giving station at Flamborough. Directional receiving apparatus will shortly be added to the stations at Fishguard, Seaforth, and Port Patrick, and if found suitable will be available for giving bearings to ships on the 600-metre wave. Nearly 7,000 bearings were given to ships by the coast stations last year. All these directional stations are calibrated periodically, and can be relied upon to give bearings which are sufficiently accurate for navigational purposes up to distances of 100 miles by day and 50 miles by night.

Wireless Beacons.—Wireless beacons, *i.e.*, stations which transmit signals at regular intervals, in order that ships with directional receivers may be able to obtain bearings, have only recently begun to be established in this country, although a fair number has been established for some time in other countries, notably in the United States, where about 20 are now in operation. It is expected, however, that a number of these wireless beacons will be erected before long at suitable places round our coasts. Trinity House has already two in operation, one on Round Island in the Scilly Islands, and the other at the Casquets in the Channel Islands, working on a 1,000-metre interrupted-continuous-wave, and the Mersey Docks and Harbour Board is installing one in the Mersey. The Humber Conservancy Board is also about to open a wireless beacon at the Spurn Lighthouse in the Humber which, working in conjunction with submarine sound signalling apparatus, will enable a ship to obtain its distance as well as its bearing from the lighthouse, and the Commissioners of Irish Lights are installing a similar beacon in Dublin Bay. The wave lengths used and signals to be transmitted by beacons are to be considered at the International Conference. There are also forms of beacon stations which emit revolving beams of waves which can be made use of by ships fitted with ordinary receivers or with special simple receiving apparatus. These revolving beacons will no doubt be used commercially before long, but at present are in the experimental stage.

An interesting use of wireless for navigational purposes is the firing of fog guns by distant control. An installation of this kind is used at Gourock to fire fog signals at Rosneath Beacon. In case of fog, the transmitting apparatus on the mainland is put in operation and the signals when received at the beacon, over a mile distant, set in operation an apparatus which explodes a mixture of air and acetylene gas. Once started, the explosions continue so long as wireless impulses are received from the transmitting station.

The Trinity House authorities use wireless telephony to link up their light vessels off Ramsgate, Walton-on-Naze, and Cromer to each other and to the shore, and the Mersey Docks and Harbour Board has made similar arrangements in the Mersey. These stations, which work on a 250-metre wave, use a call-bell arrangement to obviate constant watch. With the exception of these services and of the weather reports sent from Daventry, wireless telephony is not used for ships' safety services, or, indeed, for any other ships' services, with the exception of a few fishing vessels. This is largely due to the fact that for equal range, telephony is more costly than telegraphy and, being less selective, is not so suitable for conducting a number of different services in the same area.

Spark Working.—Spark telegraph sets are undoubtedly the most suitable for distress work as the tuning is broad, which is a distinct advantage when dealing with many ships of many nationalities and accurate tuning cannot always be expected. In this respect interrupted-continuous-wave sets are not so good as spark sets for distress work, but are permitted for that purpose as they can be so readily modified for traffic purposes to continuous-wave working which will not interfere with any distress signalling that may be proceeding at the time. The tendency, undoubtedly, is to abolish spark working altogether, even for distress purposes, but due to the expense involved, it will take a considerable time before this is accomplished. The whole question is one which will be fully considered at the International Conference.

In this country the Post Office has decided to install an interrupted-continuous-wave set in place of a spark set at the new station at Mablethorpe, and to make a beginning with the conversion of the old stations from spark sets to interrupted-continuous-wave sets.

Time signals are broadcast principally for the use of shipping from many stations throughout the world, but at present the only time signals sent from this country are those transmitted from the British Broadcasting Corporation's stations.

(To be continued.)

Television.

A television installation between New York and Washington was demonstrated in the presence of spectators recently over a distance of 250 miles. New Yorkers in the laboratories of the Bell Telephone Company heard and saw Mr. Herbert Hoover in Washington deliver a brief address. According to the daily Press, his head and shoulders were seen in a dancing shadow composed of myriad small spots flickering upon a screen less distinct than an ordinary kinema picture. Mr. Hoover's facial expressions and movements were, however, quite visible. The installation was placed in an ordinary telephone booth, consisting of a small metal box, in which the telephone user was able to see the person with whom he was conversing. The first messages were sent by wire from Washington, and later a similar demonstration was given, utilising radio from Whippany, New Jersey.

Arbitration Law Reform.

The Lord Chancellor's Committee's Recommendations: Appeals from Arbitrators' Decisions; Umpires as Sole Arbitrators; Arbitrators' Fees; Arbitration Clauses in Contracts; Speeding-up Procedure; Codification.

[From a Legal Contributor.]

In March of last year the Lord Chancellor appointed a committee to consider the existing law relating to arbitration, and to make such suggestions for its reform as they should consider desirable. Seeing that the committee were presided over by a distinguished commercial judge and that Sir Thomas Willes Chitty was amongst the members, it is not surprising that a most valuable report has been the result.

From the point of view of the electrical engineer, arbitration is a much more important form of legal proceeding than an ordinary action at law. In the first place he is often appointed to act as arbitrator; secondly, disputes in relation to the class of contract which concern him are nearly always settled in this way. It is sometimes said that lawyers object to arbitration; but so far from objecting to this kind of litigation, they recognise that it is indispensable, for it would be impossible for the Courts to get on without the assistance of arbitration. Many an action which commences in the High Court is referred to an arbitrator, either by the order of the Court or by consent of the parties, and the lawyers find that arbitration is a very profitable source of income.

The committee have indicated in their report that there are certain defects in the present law which ought to be amended. They point out that, while the Courts do possess a certain appellate jurisdiction in relation to proceedings before an arbitrator, the right to appeal is not sufficiently clear in some cases. There is, of course, no appeal from an award as such. The only way in which the decision of an arbitrator can be reviewed in a Court of law is by having an award made in the form of a special case. Special cases are of two kinds. In one form the arbitrator merely invites the opinion of the Court as to a particular point of law. The Court having given its opinion, "the case" goes back to the arbitrator to be decided on the merits. There is at present no right to appeal to the Court of Appeal from this, which is called "the consultative" decision of the Court. The committee recommend that there shall be an appeal in such a case, by leave of the Court. Again, there is no power in the Court to order an arbitrator to state a case for the opinion of the Court.

The other kind of special case is one in which the arbitrator makes his award in that form. He can be ordered to so make his award, and when it comes before the Court judgment may be entered in accordance with the findings of the arbitrator, and there is an appeal to the Court of Appeal. The committee recommend that the practice relating to the two forms of special cases shall be brought into line, with this exception that there is only to be an appeal to the Court of Appeal from a consultative case by leave of the Court.

Perhaps the most important recommendation made by the committee is that which relates to a Court which consists of two arbitrators and an umpire. It has long been recognised that this form of tribunal is cumbersome and expensive, and that where there is an agreement to refer a dispute to two arbitrators and an umpire, the umpire only to act in case of difference between the arbitrators, it nearly always happens that the arbitrators disagree, with the result that the parties have to pay for a Court consisting of three persons where one would have been enough. The committee make the very sensible suggestion that where two arbitrators are to appoint an umpire, they must do so immediately, otherwise either party may apply to the Court, or a judge, for the purpose. They further recommend that at any time after an umpire has been appointed, either party may apply for an order that the arbitrators shall be discharged and that the case shall be conducted before the umpire as sole arbitrator without prejudice to the right of the arbitrators to act as witnesses.

It is also suggested, with regard to the fees of arbitrators, that where a dispute arises in relation to fees, as where, for example, an arbitrator keeps back his award until his fees are paid, an order may be made by the Court for the payment of the fees into Court to await taxation, it being competent for the arbitrator to be heard on the matter. This will get over a difficulty which has often arisen where an arbitrator has sought to exact what is considered to be an exorbitant fee for his services.

In certain minor particulars the committee suggests one or two important amendments of the law. Thus it often happens that a big corporation such as an insurance company is able to put forward a contract containing an arbitration clause which may press hardly upon the other party. For example, the contract may provide that an application for arbitration in the case of a dispute shall be made within a very short space of time. With a view to remedying this state of affairs, the committee would like to give the Court power to extend the time for applying for arbitration. They would also have the Court enabled to remove an arbitrator who is likely to be biased. They further recommend that where one party to a dispute is charged with fraud, that might be sufficient ground for refusing to compel him to proceed to arbitration.

A good deal has been said and written about the law's delays. We do not hear so much about delay in arbitration proceedings. This may be due to the fact that they take place in private, but that there is delay and consequent injustice is quite clear from the report of the committee. It is also apparent that under the existing law one party to a dispute has power to delay the proceedings almost indefinitely. Thus an arbitrator can prolong the time for making his award to any extent, and one party to a reference who desires to delay matters as much as possible can get his arbitrator to help him in this respect. The committee propose that unless an arbitrator makes his award with dispatch, then either party to the submission may apply to the Court or a judge for leave to revoke the submission, or for an order appointing an arbitrator or an umpire in the place of the one so in default.

There are a good many minor recommendations which are of more interest to the legal than to the engineering profession: of these, one should be mentioned. It is that, instead of amending the existing arbitration Act, a new Act should be passed codifying the law on the subject, and that this Act should contain in an appendix suitable forms of award. These should be of great assistance to lay arbitrators.

We earnestly hope that the Legislature may be able to find time to pass the necessary Act embodying these reforms in the near future.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

One of the last demonstration houses to be run in connection with the campaign was that at Paisley, which is illustrated herewith. It closed on March 26th after being open to public inspection for a fortnight. In the illustration the floodlighting arrangement adopted can be seen clearly.

Demonstration House at Paisley.

Every room was equipped with thoroughly up-to-date apparatus and evoked the interest of a large number of visitors. The Paisley Circle had one of the first demonstration houses of the campaign; this was open for a fortnight in October last.

One of the houses built by the Pudsey (Yorkshire) Town Council on the Carlisle Road estate has been equipped as an all-electric house and was opened to public inspection on April 6th, by the Mayor (Councillor S. Myers).

Foreign Trade Development.

In reply to a suggestion put forward in the House of Lords that the Department of Overseas Trade should be abolished, Mr. R. B. Dunwoody, secretary of the Association of British Chambers of Commerce, recently testified to the value of the work accomplished by the Department. The Department's duties, he said, differed from those of the other departments of the State in that it helped to get orders for this country which might go elsewhere. The British Government was bound to do all in its power to further our overseas trade, and so far from abolishing the D.O.T., still more vigorous methods should be employed. Mr. Dunwoody considered that the abolition of the Department was a certain way of increasing the income tax. In a recent issue, the *Industrial Australian and Mining Standard* reported that a movement was on foot among German business men to bring pressure to bear upon the German Government to reorganise the Consular service on the lines adopted by the American Department of Commerce. The efficacy and efficiency of that department are extolled: it is said that United States foreign trade was increased by the Department by £100,000,000 during 1925, while the cost of the whole organisation is less than £600,000 per annum. Over two million inquiries were dealt with in 1925, and 50 per cent. of the inquiries are answered within 24 hours.

Foreign Competition.

The Dewsbury Town Council, on April 7th, recommended the Electricity and Tramways Committee to purchase foreign electric cable, when advisable, in view of the lowest tenders from British firms in the Cable Makers' Association having been from 25 to 34 per cent. higher than the lowest foreign tenders. The Town Council also decided to draw the attention of the Incorporated Municipal Electrical Association to this matter.

Badminton.

The badminton team of the St. Helens Cable and Rubber Co., Ltd., met the team of Callender's Cable and Construction Co., Ltd., on April 4th and beat them by eight events to one. The successful team comprised Mr. J. H. Brooking and Miss P. Baines; Mr. H. Evans and Mrs. Carey; and Mr. R. Wetton and Miss E. Bridge.

The Metropoljtan-Vickers Electrical Co., Ltd., has a badminton expert in the person of Mr. T. P. Dick, who reached the semi-finals in the 1927 open singles all-England championship, and has won many events.

German Exports to New South Wales.

During December last electrical appliances valued at £1,652 were supplied by Germany to New South Wales, states the *Board of Trade Journal*.

Local Exhibitions.

Among the exhibits at the National Trades and Industrial Exhibition which is being held at Bingley Hall, Birmingham, from March 21st to May 14th, is that of the City of Birmingham Electric Supply Department, which comprises two model rooms of an "all-electric" house. Here are shown electric lighting fittings and electric fires, cooker and wash-boiler, a "Frigidaire" cabinet for domestic use, irons, kettles, a vacuum cleaner, a food mixer, and other electric labour-saving devices. One section of the Corporation's display—the kitchen—is depicted in the accompanying illustration.

An Electric "Kitchen" at Birmingham.

Another electrical exhibit is that of Tellus Super Vacuum Cleaner, Ltd., 394, Oxford Street, London, W.1, which is showing a new type of electric cleaner which can be converted into a fan, hair dryer, and bellows. Electrolux, Ltd., is showing its vacuum cleaners and refrigerators.

Erith.—An exhibition of various manufactures and commodities was held at the Erith Technical College on April 11th, 12th, and 13th. The arrangement of the electrical section was undertaken by Messrs. Dickenson & Co., Bexley Heath, and it comprised a complete range of "Magnet" household electrical appliances and a variety of "G.E.C." fittings. It is interesting to learn in connection with this exhibition that the district power rate was reduced from 2d. to 1d. per kWh as from April 1st.

East Kilbride.—The Clyde Valley Electrical Power Co. held a successful exhibition at East Kilbride, Renfrewshire, from April 7th to 9th. The company's engineers were in attendance and answered inquiries regarding supply, and electrical appliances of all descriptions were on view.

Radio Exhibition Poster Competition.

The Radio Manufacturers' Association is organising a competition to obtain a suitable poster to advertise this year's National Radio Exhibition. A leaflet setting forth the conditions of the competition has been printed and can be obtained from the secretary of the Association, Astor House, Aldwych, W.C.2.

Trade with Argentina.

A further address upon this subject was given by Sir A. Malcolm Robertson at a recent dinner of the Incorporated Sales Managers' Association. He said that, although British capital had provided public utilities all over Argentina and had developed many of the country's resources, Great Britain was losing ground in the Argentine market. Incessant strikes in this country had led to a lack of confidence on the part of foreign buyers, our prices in many cases were too high, and another handicap was high freights. Prices might be lowered and quality maintained by standardisation and mass production where these were possible. A carefully-thought-out propaganda campaign was necessary. It was useless repeating "Buy British goods"; the foreign buyer wanted to know *why* he should do so. Salesmanship was weak. The market could only be studied on the spot and not from a London office. Last, the 2 per cent. tax on foreign loans rendered it impossible for us to compete. If, however, an effort was made by British traders to co-operate, advertise, and work, we still had a great future in South America.

New French Company.

A new company has been formed at Boulogne-sur-Seine, with a capital of 535,000 fr. and the title La Société Le Fil Magneto, to manufacture electrical apparatus.

German Industrial Revival.

Herr F. von Mendelssohn, president of the German National Committee of the International Chamber of Commerce, was the guest of the British National Committee at a luncheon last week. *The Times* report of his speech states that Herr Mendelssohn said that Germany had seen the worst of economic stagnation and that conditions had begun to improve. In the second half of 1926 production and consumption experienced a steady augmentation which could not be explained merely by such adventitious events as the labour difficulties in British mining. It was due to the maintenance of regular prices, to industrial investments for the improvement of production, to increased savings, and to the increased purchasing power of the nation. A tendency towards amalgamation in industry formed the special feature of German economic organisation at the present time. Amalgamation within the Reich had bridged the way to an understanding with the industries of other countries; and this, in its future evolutions, might well lead to agreements which would do more than any customs tariffs or import prohibitions to preclude market anarchy and wild competition between one country and another.

Belgian Telephone Works Extension.

In order to meet the increasing demand for telephone material in Belgium, the works of the New Antwerp Telephone and Electrical Works Co. are about to be considerably enlarged.

Swiss Electrical Industry.

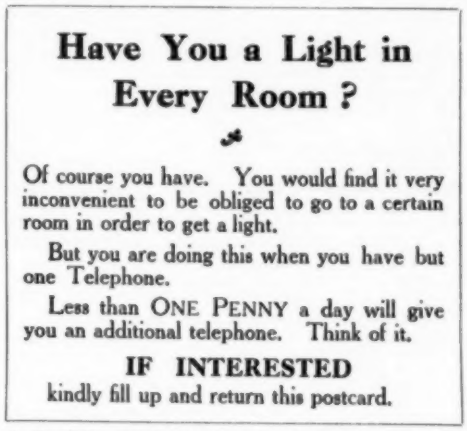
In a review of the progress of Swiss industries during 1926 issued by the Swiss Bank Corporation, it is stated that the important machine manufacturing industry of the country, after having suffered considerably during the general economic crisis commenced last year to recover, at any rate in several of its branches. As in previous years, an outlet for the greater part of the products of this industry had to be sought abroad, and it is remarked that in the second half of 1926 a severe form of protection was applied in certain countries. The review also remarks on the various resolutions passed at the recent Empire Conference in London in favour of the growing industry of the Dominions and that of the United Kingdom. It adds that the absence of the Russian market was particularly felt in Switzerland. Yet the level of employment generally in the electrical manufacturing industry was satisfactory, owing, partly, to the orders placed by the Federal Railways for the purpose of accelerating their electrification programme. As, however, the completion of all this work is approaching rapidly, the hope is expressed that orders from foreign countries, where Swiss finance is extending its influence in electricity supply companies, will gradually lead to contracts to follow those which are now nearing completion.

An X-Ray Warning Notice.

We have received a sample of the notices which Messrs. Watson & Sons (Electro-Medical), Ltd., are issuing with every X-ray equipment they supply, warning all users as to the precautions which should be conscientiously observed when operating the equipment. Clearly printed and permanently covered with celluloid, one copy is fixed inside the transformer cabinet, another is supplied loose for hanging on the wall of the X-ray room, whilst a third copy is attached to the instructions issued for handling the plant. Messrs. Watson are thus doing their best to ensure the safety of those who operate X-ray apparatus.

Telephone Development.

It is generally believed that the Telephone Service hides its light under a bushel and that it waits for people to approach it if they want telephones. This is not altogether true, as the accompanying illustration proves. This card, sent out by the Controller of the London Telephone Service,


Have You a Light in Every Room ?
Of course you have. You would find it very inconvenient to be obliged to go to a certain room in order to get a light.
But you are doing this when you have but one Telephone.
Less than ONE PENNY a day will give you an additional telephone. Think of it.
IF INTERESTED
kindly fill up and return this postcard.

A Card Issued by the London Telephone Service.

shows that not only is new business being sought, but an endeavour to extend existing services is being made. We may yet see a figure of two telephones per head of population!

The Telephone Development Association reports that during the run of the Ideal Home Exhibition no fewer than 115 agreements for telephone service—an average of five every day of the exhibition—were signed at the Association's stand. In addition, 239 names and addresses—172 in London and 67 in other parts of the country—were left by visitors who desired a visit from a Post Office representative in order to discuss the installation of service. These are being followed up by the Post Office, and in some cases agreements have already been secured. In the daily competition for a telephone free of rent for a year there were altogether 22,613 entries. Ten of these telephones fell to the London area, and the remainder to districts as widely separated as Aberdeen and Southampton. It is the intention of the Association to repeat the experiment at Manchester at a "Brighter Homes" Exhibition to be held from April 22nd to May 21st.

Unemployment.

After a long series of reductions, the number of unemployed rose by 3,170 during the week ended March 28th. The number at that date was 1,081,700, as compared with 1,078,530 on March 21st and 1,013,610 on March 29th, 1926.

Electric Power in Industry.

Further industries are dealt with in Preliminary Report No. 6 upon the Census of Production, published with the *Board of Trade Journal* for March 31st. The shipbuilding trades are first treated and it is shown that in 1907 these trades (in the United Kingdom) possessed 35,191 kW of generating plant, while in 1924 (in Great Britain) the aggregate capacity was 47,343 kW. Of the latter, marine engine works accounted for 35,756 kW, and shipbuilding yards for 11,587 kW. The aggregate capacity of electric motors installed was 498,415 h.p. in 1924; energy for 422,130 h.p. of these was purchased.

The generating plant installed in connection with the cement trade rose from 6,685 kW in 1907 to 43,700 kW in 1924. Motors aggregating 69,759 h.p. were installed, energy for 21,884 h.p. of which was purchased.

In 1907, 386 kW of generating plant was in use in the brush-making trade; in 1924 the figure was 1,478 kW, and the total h.p. of motors installed was 3,848 (2,138 h.p. purchased). The statistics for the coconut fibre, horsehair, and feather trades were as follows:—Generating plant, 1907, 27 kW; 1924, 645 kW; motor power installed 2,221 h.p. (1,548 h.p. purchased).

The supplement for April 7th deals first with the wire trades, and shows that the amount of installed generating plant rose from 2,336 kW in 1907 to 9,991 kW in 1924. In the latter year the capacity of installed motors was 71,612 h.p., power for 55,103 h.p. of which was purchased. The match trade power plant rose from 116 kW in 1907 to 2,348 kW in 1924. At the same time there was 3,152 h.p. of electric motors installed, power for 615 h.p. of which was purchased. The figures for the cardboard box trade were:—Generating plant: 1907, 478 kW; 1924, 903 kW. Motors installed, 5,710 h.p.; energy purchased for 4,737 h.p.

Syrian Tariff Modification.

It is reported that the duties upon electric pocket lamp batteries imported into Syria have been altered from 40 piastres per 100 to 25 per cent. *ad valorem* in the case of batteries from the United States or member countries of the League of Nations, and 50 per cent. *ad valorem* in the case of goods from other countries.

D

The Brazilian Market for Radio Apparatus.

Radio communication is fairly well extended in Brazil, and there are a large number of amateurs. The number of persons who have received authority from the Brazilian Telegraph Department is about 32,000, but the number of those in possession of receiving apparatus without such authority is much above those with licences. Of the apparatus imported, 5 per cent. comes from France, 6 per cent. from Germany, 20 per cent. from Great Britain, and nearly 70 per cent. from the United States. There is preference for valve sets, and those mainly in use have from three to five valves. About as many complete sets are sold as there are sets assembled from separate parts. For the former high prices are realised. The Americans have an advantage inasmuch as the different makes are standardised to some extent, and consequently spare parts can be obtained easily and cheaply. The Telegraph Department owns six stations of the Telefunken type on the coast, the power varying from 2 to 5 kW, transmitting at 300, 600, and 900 metres. There are also two continuous wave stations. Recently the Government established an extra high power station for international communication, the transmitting section of which is situated at Sepetiba and the receiving station at Jacarépagua. The installation is partly of French and partly of German manufacture, with a few pieces of apparatus supplied by British or American firms. There are a number of journals issued dealing with wireless matters.

New Catalogues and Lists.

Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1.—Fully illustrated and priced 72-page catalogue of broadcast radio receiving sets and component parts. The V.2 receiver has been omitted, as very few remain in stock; gramophone amplifier equipment with electrical "pick-up" has been included, whilst amongst new components are the KL.1 transformer and power choke, a potential divider for use with anode-battery eliminators, a novel valve switch, and a new rubber valve holder.

Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—An illustrated pamphlet (No. 158), describing a new pattern "Memlock" change-over switch.

The Cork Manufacturing Co., Ltd., South Chingford, E.4.—A brochure advertising "Langite" jointing material for packing purposes, &c.

Empson Emulsifiers, 26, Bridge Road, Taylor's Lane, Willesden, N.W.10.—An illustrated pamphlet describing the making of cream by means of the Empson emulsifier.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A booklet dealing in an interesting manner with the company's intercommunication system, and a pamphlet upon the same subject.

Messrs. C. W. Outram & Co., Woodville, near Burton-on-Trent.—An illustrated catalogue of porcelain insulators for electric lighting, heating, and power purposes.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—April price sheet, containing illustrated particulars of all kinds of electrical apparatus and appliances.

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., U.S.A.—A series of illustrated pamphlets describing the company's static condensers, current transformers, electric furnaces, loom motors, and paper-mill drives.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—April calendar-blotter advertising "Jackson" wash boilers with a special spraying device.

The Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex.—An illustrated publication dealing with the "Drayton" automatic de-superheater or attemperator.

The Wholesale Electric Lamp Co., Ltd., 150, Vauxhall Bridge Road, S.W.1.—A net trade price list of electrical materials, accessories, and appliances, including lighting fittings. Also an illustrated and priced leaflet advertising "Royalstone" dustproof lighting fittings.

The Dundee Electrical Repairs Co., Ltd., Erskine Street, Dundee.—A leaflet illustrating and describing an "indestructible" d.c. motor starting and control pillar.

The Brush Electrical Engineering Co., Ltd., Loughborough.—Publication No. 100/0-6a, an illustrated description of Brush-Ljungström turbo-generators of outputs from 5,000 kW normal to 7,000 kW continuous maximum rating.

Messrs. Wm. Geipel & Co., Vulcan Works, St. Thomas Street, S.E.1.—A pamphlet advertising "Ward-Leonard" dimmers for theatre lighting, as fitted in the Roxy Theatre, New York, which seats 6,200 people.

The L.P.S. Electrical Co., Ltd., Avenue Road, Acton, W.3.—A pamphlet advertising the company's test and battery clips, &c. Priced and illustrated.

The Tungstone Accumulator Co., Ltd., 3, St. Bride's House, Salisbury Square, E.C.4.—A folder advertising "Tungstone" accumulators, which are claimed to be free from permanent over-sulphation.

The Premier Electric Welding Co., Ltd., Abbey Wood, S.E.2.—An illustrated list dealing with the company's a.c. arc-welding plant. Also two booklets—one containing a reprint of a paper on "Thermal Disturbance in Iron and Steel during Welding," the other being a handbook for electric welders.

Messrs. Sydney Jones & Co. (London), Ltd., 28, Endell Street, W.C.2.—A price list of screws, nuts and washers of all kinds.

The Iron & Nickel Battery Co., Ltd., 17-19, Cockspur Street, Pall Mall, S.W.1.—An illustrated and priced pamphlet describing the "Ionic" electric hand lamp.

Trade Announcements.

Messrs. Philpot & Son, electrical engineers, of Canterbury, have removed from 3, St. George's Street, to 1, Iron Bar Lane, where the business will still be conducted by Mr. D. McKellar.

Messrs. Rossleigh, Ltd., of 31, Dumbarton Road, Stirling, announce that they are giving up the wireless branch of their business.

The new telephone numbers of Messrs. Mylan & Smith (Engineers), Ltd., of Sheffield, are 21371 and 21372. Sheffield changed over to the automatic telephone system on March 5th.

The Imperial Motor Works (Lyndhurst), Ltd., has changed its name to New Forest Services (Lyndhurst), Ltd.

The Kartret Switchgear Co., Ltd., is moving its sales organisation to its works at Wellesley Road, Sutton. After Easter all communications should be directed to that address.

W. R. Bottomley Private Telephone Co. has removed to Providence Electrical Works, Luck Lane, Marsh, Huddersfield. Telephone No. 3072.

Bankruptcy Proceedings.

A. J. Garrod, Whitehorse Place, Wellingborough, radio apparatus manufacturer.—The public examination of this debtor was held recently at the County Hall, Northampton. According to the statement of affairs there was a deficiency of £2,486. Debtor stated that in 1924 he commenced business as a valve repairer as the Unitron Valve Company, with £600. His business was fairly successful, and he experimented with a new valve. He required further capital, and a certain gentleman subscribed £250. An agreement was proposed under which he was to pay one-fourth of the profit. Later debtor received further sums amounting to £750 altogether, while two people each gave a £250 guarantee to the bank. Debtor said that another firm had come in with assistance in perfecting certain improvements which promised success, and it claimed as a debt the money which it had already lost, but debtor held that it was money spent on work from which they mutually hoped to benefit. The examination was adjourned.

A. H. Richardson, Wellingborough Road, Finedon, Northants, trading as "Radio Supplies," wireless manufacturer.—The public examination of this debtor was held recently at the County Hall, Northampton. The statement of affairs showed liabilities of £966, against assets of £98, leaving a deficiency of £868. Debtor stated that for some time he travelled for a radio firm at Leeds, and in February, 1925, opened a branch for the concern at Finedon, but later the firm went into liquidation. He then advertised at Kettering for capital, and was approached by another, who agreed to put £350 into the Finedon business, on condition of an equal division of profits with the debtor. A partnership was formed in May, 1925, and existed until April, 1926, when the partner, who had put further sums in, left, being paid £1,480. Debtor admitted that he had never done sufficient business to pay his way properly. The examination was adjourned.

T. F. Collier, 64, Union Street West, Oldham, electrician.—The first meeting of creditors was held recently at the Official Receiver's Offices, Manchester. The statement of affairs showed liabilities of £77, and there were no assets. Debtor attributed his failure to lack of capital. In 1919 he commenced business as an electrical engineer at Werneth, with £500 left by his father. The business declined, and in August, 1922, he sold it to a limited company for £430, in 430 £1 shares. In July, 1926, he recommenced as an electrical engineer, but owing to lack of capital was not successful, and in January last his trade effects were realised under an execution. The matter was left with the Official Receiver as trustee of the estate.

D. T. Donovan and H. A. Langlois, trading in co-partnership as the London Electrical Company, 119, St. Mary Street, Cardiff.—The adjourned public examination of these debtors was held recently at the Law Courts, Cardiff. Debtors agreed that they sustained a loss of £600 from May last year to December 13th, but did not admit that selling goods under cost contributed to their present position. Donovan agreed that £190 had been received in respect of apprentices, £170 of which was still owing, but they promised to try to repay this amount. The examination was closed.

E. Temple and Mrs. J. E. Burkett (Weston Electrical Co.), wireless dealers and electrical contractors, 105, Canterbury Street, South Shields.—First meeting held April 12th at the Official Receiver's office, Government Buildings, 81, St. Mary's Place, Newcastle-on-Tyne. Public examination, May 5th at the Court House, Newcastle-on-Tyne.

F. J. TIZZARD and N. TIZZARD (TIZZARD BROS.), electrical engineers and contractors, 27, Dalkeith Street, Barrow-in-Furness, and 121, Market Street, Dalton-in-Furness.—Trustee, Mr. W. G. Pearson, Official Receiver, 16, Cornwallis Street, Barrow-in-Furness, released March 30th.

J. R. MARTIN, electrical engineer, 11, Middlesbrough Road, South Bank, York.—First meeting, April 14th at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. Public examination, April 29th at the Court House, Middlesbrough.

F. F. GREGORY, electrical engineer, 2a, Westbourne Road, Luton.—Trustee, Mr. D. Helliar, Official Receiver, The Parade, Northampton, released March 30th.

MRS. H. SPENCER (Spencer & Son), wireless and cycle dealer, 30, Watergate, Grantham.—Receiving order made April 6th on debtor's own petition.

P. CHESHIRE (P. Cheshire & Co.), electrical engineer and contractor, Water Street Works, Middleton, Lancaster.—Receiving order made April 5th, on debtor's own petition.

W. J. BROOME (Stockport Electrical Co.), electrical engineer, Garrick Place, Daw Bank, Stockport.—Receiving order made April 5th, on debtor's own petition.

Company Liquidations.

CARPAX CO., LTD., shippers of electrical and wireless goods, 312, Deansgate, Manchester.—A meeting of creditors was held last week, at Manchester, when Mr. J. Wilson, the liquidator in the voluntary liquidation of the company, reported that the liabilities were £727, all due to unsecured creditors. The assets were estimated to realise £473 net, leaving a deficiency of £254, so far as the creditors were concerned. It was stated that in addition to the liabilities mentioned there was a contingent liability in respect of an agency agreement, under which certain goods held by the company might have to be re-shipped. The company held a conference of its principal creditors on November 1st last, when figures were presented showing the position on the basis of a going concern, and they disclosed a surplus of about £280, the stock being valued at cost prices. That conference was called owing to the fact that the company was short of liquid capital, due to a slump in the wireless trade. Creditors for more than £10 each then decided to postpone payment of their accounts until March 31st this year in order that the company might have a chance to retrieve its position. A resolution was passed confirming the voluntary liquidation of the company with the present liquidator.

SERVICE RADIO, LTD.—Winding up voluntarily. Liquidator, Mr. I. Levy, 27, Chancery Lane, W.C.2. Meeting of creditors, April 19th at the Institute of Chartered Accountants, Moorgate Place, E.C.

CITY FUSEBOARD CO., LTD.—A meeting of members is called for May 9th at 147, Corporation Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. J. W. Blackham.

CLEVELAND ELECTRICAL ENGINEERING CO., LTD.—A meeting of members is called for May 6th at 43, Albert Road, Middlesbrough, to hear an account of the winding up from the liquidator, Mr. M. McGilligan.

RADIO PRODUCTIONS (LEEDS), LTD.—A meeting of members is called for May 5th at Standard Buildings, City Square, Leeds, to hear an account of the winding up from the liquidator, Mr. C. H. Baker.

MONTREAL TRAMWAYS & POWER CO., LTD.—A meeting of creditors will be held on April 25th, at Room 611, Power Building, Craig Street West, Montreal. Liquidator, Mr. F. H. Strouvelle, 24-28, Lombard Street, E.C.

LLANDRINDOD WELLS ELECTRIC LIGHT & POWER CO., LTD.—A meeting of members is called for May 16th, at the Offices, Llandinam, Montgomery, to hear an account of the winding up from the liquidator, Mr. G. Edwards.

AUTOMOBILE ELECTRICAL REPAIRERS, LTD.—A meeting of members is called for May 9th, at Sardinia House, Sardinia Street, W.C., to hear an account of the winding up from the liquidator, Mr. N. J. Dodd.

Private Arrangements.

F. J. CHARLTON, trading as the Essex Wholesale Electrical Co., 709, Romford Road, Manor Park, E.12.—A meeting of creditors was held on April 4th, at the offices of Mr. F. Sharles, 52, Queen Victoria Street, E.C., when a statement of affairs was presented which disclosed liabilities of £440 and net assets of £312, leaving a deficiency of £126. The debtor commenced business in March, 1925, with a capital of £518. The balance sheet for the year to December 31st, 1926, showed purchases of £1,804 and sales of £2,293. There was a net profit of £131 for the year. From January 1st to March 31st last the purchases were £246 and the sales £326, whilst the debtor's drawings were £88. No offer was made, and it was decided to confirm the deed of assignment already executed to Mr. Sharles as trustee, whilst a committee of inspection was also nominated. The following are creditors:—

	£		£
Electric Cables, Ltd. ...	21	Hackbridge Cable Co.,	58
London Conduit Fittings Co.	29	Stella Conduit Co., Ltd.	46
Scupham & Wood, Ltd.	44	Sandford & Co.	22
		De Maid, Ltd.	22

G. W. COVE, electrical engineer, 19, Bristol Road, Brighton.—A meeting of creditors was held recently, when a statement of affairs was presented by Mr. A. E. Orbell, 151-152, North Street, Brighton, which disclosed liabilities of £485, of which £385 was due to the trade and £100 to a cash creditor. The assets were estimated at £114, leaving a deficiency of £371. The cash creditor was the debtor's sister, in respect of money lent. The debtor had been in the employ of a well-known company, receiving a retaining fee and being paid for all jobs which he did. He was also allowed to carry on business on his own account. The arrangement did not prove successful so far as the debtor's own contracts were concerned. There was one contract for £170, which cost £300 in time and material to complete. Last October the debtor was taken ill, and was away for some months. In February a fresh arrangement was entered into with his employers, his retaining fee being increased, whilst he was also to continue to trade on his own account. The drawings had been at the rate of £6 a week. Lately creditors had been pressing, and a deed of assignment was executed to Mr. Orbell on March 30th. A resolution was passed confirming the deed already executed, and it was stated that the cash creditor would withdraw her claim. The following are creditors:—

	£		£
D'Accord	23	Siemens & English Electric Lamp Co., Ltd. ...	132
General Electric Co., Ltd.	55		

C. J. P. DAVIES, 9, Cheapside, Liverpool, electrical engineer.—A meeting of creditors was held on April 5th, at the offices of Messrs. R. Duncan French & Co., accountants, Liverpool, when a statement of affairs was presented which disclosed liabilities of £1,732; £1,248 of that was due to the trade and there was a loan creditor for £484. The net assets totalled £500, leaving a deficiency of £1,231. The debtor commenced business in November, 1923, with a capital of £150. Accounts prepared showed that for the period to the end of September, 1925, the sales were £3,700, and there was a loss of £15. In the following six months a loss of £275 was sustained. The accounts at that time showed a deficiency of £165. Since then the debtor's father had advanced certain sums of money. The present position was attributed to losses sustained on contracts, absence from the business through illness, and bad trade. An offer was made of 12s. 6d. in the £, which was subsequently increased to 15s. in the £, and was accepted, payable as to 10s. in three months and 5s. in six months. The following are creditors:—

	£		£
Dodd & Oulton	119	Downes & Davies ...	374
Hart, Collins & Co. ...	155	Lowe & Sons, G.	37
Wallin & Co.	48	General Electric Co., Ltd.	66
Liverpool Electric Cable Co.	20	Bankers	261
Stearn Electric Co., Ltd.	20	Davies, H. E.	483
Daniels & Son, T. ...	40		

A. J. KIRKBY, Whitchurch, Ross-on-Wye, electrical engineer and radio factor.—Mr. P. S. Booth, 14-17, Holborn Viaduct, E.C., states that an investigation shows liabilities of £929 and assets of £228. The debtor commenced in the radio business 15 months ago with no capital of his own. His turnover for the first 12 months was about £1,000. A relative advanced sums from time to time, and her total claim amounts to £400. She has been asked to withdraw her claim, and in the meantime Mr. Booth is taking steps to realise the assets to the best advantage.

WELCO PATENTS, LTD.—Following informal meetings of the larger creditors, a scheme is proposed whereby creditors will be allotted 6 per cent. debentures in respect of the sums owing to them. In the meantime the receiver for the present debenture holders is carrying on the business with a view to the liquidation of those debentures.

Deed of Arrangement.

J. H. GATH, trading as the Gath Electrical Engineering Co., Halifax.—The trustees have issued a statement as at March 22nd. They say that a number of the assets remain unrealised; the delay in winding up the estate is due to the carrying on of the business as decided at a creditors' meeting in September last. It is hoped to complete the winding up within six months of ceasing to trade.

Anglo-Italian Conference.

The conference between representatives of the Federation of British Industries and of the Fascist Confederation of Italian Industries, held last week, discussed a number of questions of mutual interest and reached a certain measure of agreement. Among the matters dealt with were:—Uniformity of Customs practice; the adoption of specific standards for the valuation of imports and exports; the exchange of production statistics and information; international industrial agreements; fairs and exhibitions; the double taxation of the two countries' nationals; and international conferences.

The Luxemburg Concession.

The Council of State of Luxemburg has decided to give its approval to the project for the electrification of the province submitted by the Société des Centrales Electriques des Flandres. Two schemes are under consideration, the main one comprising the establishment of a distribution system, estimated to cost about £350,000, 25 per cent. of which would be borne by the Government.

Social Events.

The Amateur Dramatic Society of the Automatic Telephone Manufacturing Co., Ltd., assisted by the A.T.M. Orchestral Society, gave a successful joint performance at Liverpool on April 5th. Three short plays, comprising a comedy—"The Amateur Palmist"; a drama—"The Touch of the Child"; and a farce—"Uncle Sam," were presented by the Dramatic Society under the direction of Mr. J. Ready. During the intervals the Orchestral Society, under Mr. C. Brandreth, rendered selections.

On April 1st, the Victor Works of the Automatic Telephone Manufacturing Co., Ltd., held its final Social Club ball of the season at Colomba Hall, Liverpool. The function was well attended and resulted in a highly enjoyable evening. Messrs. Whitby and Anderson acted as M.C.'s.

Copper, Lead and Rubber Prices.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report April 12th:—No change in copper prices. English pig lead, £28, 5s. decrease.

Messrs. Edward Till & Co. report April 12th:—No change in the price of india-rubber, Para fine.

For Sale.

Ashford Urban District Council Electricity Department has a Lister electric lighting plant for disposal. Warrington Corporation Electricity Department has for disposal a number of second-hand d.c. motors. (See our advertisement pages to-day.)

Book Notices.

"Deafness Explained" is the title of a small book by Mr. C. M. R. Balbi, A.C.G.I., A.M.I.E.E. (John Bale, Son and Danielsson, Ltd., price 1s. net), in which the author deals with the subject as an electrical engineer in the interests of those afflicted with deafness. In a foreword Lord Charnwood sympathetically commends the work. The author, who is honorary consulting electrical adviser to the National Institute for the Deaf, deals with the principles of sound and hearing, and after outlining the causes of deafness, treats of the remedies that are available—most of them physical not medical, and many of them, of course, dependent upon electrical appliances, some of which he has described in our pages. A useful bibliography is appended to the brochure, which itself forms a very welcome addition to the rather meagre literature on this important but neglected subject.

"Year Book and Directory of the *South African Mining and Engineering Journal*, 1927." (460 pp.) London: Argus South African Newspapers, Ltd. Price, 12s. 6d., post free.—This book deals with the whole of the Union of South Africa, Rhodesia, and the Congo. It is, of course, mainly devoted to mining and industry, and there are several sections of interest to our readers. Probably the most useful is the directory and buyer's guide section, giving the names and particulars of the principal firms in the engineering, electrical, machinery and other trades. The electrical section deals with the activities of the Victoria Falls and Transvaal Power Co., Ltd., and other supply undertakings, and includes a full list of public undertakings with details of prime movers, voltages and frequencies, &c.

"The Colliery Year Book and Coal Trades Directory, 1927." Pp. 104+1032. London: The Louis Cassier Co., Ltd. Price 1 guinea net.—One effect of the prolonged coal dispute of last year is indicated in this 5th edition of the Colliery Year Book by the reduction in the list of colliery owners. Several additions have been made to the Statistical Section, including some data of the coal-mining industry in foreign countries. Several new articles are contained in this edition, including "The Future of the Coal-mining Industry," by Austin Hopkinson, M.P. "Some Notes on Machine Mining," by Lionel C. Maitland, contains much interesting information concerning the use of electricity in mines. A list of the electricity supply undertakings in the country is given. As usual the constitution of the various representative bodies in the industry is given, including the Mines Department and the employers' and employés' associations.

"Post Office Electrical Engineers' *Journal*," Vol. XX. Part I. April, 1927. London: Electrical Review, Ltd. Price 1s. 6d. net.

"Kempe's Engineer's Year Book for 1927." Pp. xliii+3101. London: Crosby Lockwood & Son. Price 30s. net.

"Selected Papers from the *Journal* of the Institute of Electrical Engineers of Japan." No. 11, "Temperature rise of Electrical Machinery and Comparison between Single and Double Ratings." No. 12, "Measurement of Acoustic Constants of Cloth." The Institute, 21, Mitsubishi Building, Marunouchi, Tokyo.

The Spring List of Sir Isaac Pitman & Sons, Ltd., contains particulars of a number of works upon business subjects, including accountancy, salesmanship, &c., as well as several technical and scientific books.

Scientific Papers of the U.S.A. Bureau of Standards. Vol. 21, No. 543, "Linkage-current Diagram for Representing Magneto Operation" (20 cents). Vol. 21, No. 534. "Effect of Eddy Currents in a Core consisting of Circular Wires." (10 cents.)

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI, No. 3. March, 1927. New York: The Institute. Price $1.

The German Electrical Industry.

According to the reports issued by the Prussian Chambers of Commerce, a revival of business took place to a moderate extent in almost all branches of the electrical industry in March. The increase in the consumption during the winter months has induced the supply works to begin placing orders for the next season on a larger scale, while various tramways have undertaken extensions and replacements. Further orders were given out by the Reich railways in connection with the electrification of the Berlin City and Circle railways. Orders were placed by the industrial districts, and a confident tone prevails which is manifested not so much in an increase in the orders as in the preparation of large schemes. The increase in building operations is also acting as a stimulus. Business in telegraph apparatus, fire alarms and clocks, and automatic exchanges, again improved, but the turnover in telephone apparatus was unsatisfactory. A slight improvement took place in the sale of electromedical products, and the sale of glow lamps also made progress.

Recent Contract.

The Wallasey Electricity Department has recently placed with MESSRS. SIMON-CARVES, LTD., an order for two of their water-tube boilers, each designed for a maximum evaporation of 70,000 lb. per hour at 300 lb. per sq. in. pressure, together with economisers, superheaters, chimneys, grit catchers, induced draught plant, coal bunkers, automatic coal weighers, unit type pulverisers, boiler feed pump, and all necessary valves and instruments.

Lighting and Power Notes.

Accrington.—REVISED ELECTRICITY CHARGES.—The Town Council has revised the electricity charges from April 1st as follows:—Lighting, 5d. per kWh; heating and domestic purposes other than lighting, 0.7d. per kWh. On the ratable basis there will be a fixed charge of 15 per cent. per annum on the ratable value up to £100, plus 10 per cent. over £100, with a charge of 0.6d. per kWh. For power, rates vary from 2½d. for the first 100 kWh per quarter to 0.75d. to the largest power users. For shop window lighting after shop hours one-half the flat rate is charged.

Bath.—ELECTRICITY IN SMALL HOUSES.—Regarding the supply of electricity to the new houses at Newbridge and Larkhall, the electrical engineer has submitted a proposal to the Electric Lighting Committee for a special tariff to be applied to consumers of electricity in the Corporation houses, where the houses have been wired by the Housing Committee, as follows:—A standing charge of 48s. per year, plus 1d. per kWh for all electricity consumed for any purpose. The accounts would be collected with the rent at the rate of one shilling per week, and a debit or credit, as the case may be, given at the end of each quarter. The committee has approved the report and instructed the engineer to put the scale into operation.

Birkenhead.—LOAN.—The Electricity Committee has recommended the Town Council to apply for sanction to a loan of £41,597 in connection with the electricity supply to Wirral.

Brentwood.—INSTITUTION LIGHTING.—In accordance with the requirements of the Board of Control, the Essex County Council proposes to convert the lighting of Brentwood Mental Hospital from gas to electric lighting. The cost of the installation of the necessary plant and wiring will be £22,750.

Bromley (Kent).—ELECTRICITY IN BULK.—The Town Council has applied for an Order authorising it to supply electricity in bulk to the Chislehurst Electric Supply Co., Ltd.

Canada.—ELECTRICAL DEVELOPMENT.—The Ontario Hydro-Electric Power Commission will this year make considerable extensions to its system, the estimates of the Provincial Government including an appropriation of $14,970,000 for this purpose. The increase of transformer capacity in several of the leading cities and towns of Western Ontario will cost $5,500,000. The sum of $7,225,000 will be required for the construction of transmission and distribution lines, of which $5,000,000 will be devoted to the erection of a 220,000-V line to Eastern Ontario, including the cost of transformer stations. The development of the Thunder Bay system will cost $4,045,000, of which $3,875,000 will be spent on the Alexander Landing scheme now under construction. Bonuses for the construction of rural transmission lines, half the cost of which is borne by the Government, will be substantially increased, the estimate for this purpose ($750,000) being $250,000 in excess of the vote last year.

The Commission's operations during 1926 yielded a surplus of $565,000 on investments aggregating $203,000,000. During the year additional plant with a capacity of 100,000 h.p. was installed, and the Commission contracted for the future delivery of 340,000 h.p. from the Ottawa River.

In order to supply the growing requirements of the Rouyn Copper goldfield of Quebec, where active work is being carried on by many mining companies, the Canada Northern Power

Company is installing two additional units at its Quinze Falls plant, at a cost of $1,250,000.—*Reuter's Trade Service* (Ottawa).

Cheltenham.—REVISED ELECTRICITY CHARGES.—The Corporation Electricity Committee has revised the electricity charges as follows:—Lighting (maximum demand): For the first 125 hours' use per quarter of the maximum demand, 6d. per kWh; for all additional energy, 2d. per kWh; flat rate, ordinary consumers (other than special supplies), 5d. per kWh; larger consumers (subject to guarantee and discounts as before), 4d. per kWh; churches and chapels, 4d. per kWh; kinematograph halls, combined rate, 2½d. per kWh. Power (other than special contracts), 1¼d. per kWh. Meter rents, 9d. per quarter for each meter not exceeding 1,000-W capacity, and 1s. per quarter for each meter above 1,000-W capacity. Slot meters, 7d. per kWh.

Crewkerne.—ELECTRICITY SUPPLY.—It was reported at a recent meeting of the Urban District Council, that the promoters of the electricity undertaking had now complied with all the Council's requirements. A letter was read from Mr. J. A. Purves, joint promoter of the undertaking, pointing out that they were prepared to agree to the Council having the option to purchase at 22, 32, or 42 years. A draft of the proposed scheme was now being prepared, but no action had been taken regarding the inclusion of any area outside the urban district. The promoters thought, however, that it would be desirable to include certain of the adjacent parishes, which could get their electricity supply from Crewkerne, as a centre, more easily than from any other place.

Douglas (I. of M.).—ELECTRICITY SUPPLY.—In the Tynwald Court recently the Corporation applied for sanction to the borrowing of £83,000 for plant extensions, buildings, mains and services, &c., in connection with the supply of electricity within the borough. According to the *Isle of Man Times*, Col. T. C. Ekin, Inspector to the Electricity Commission, questioned the present site's suitability for steam engines on the grounds (1) that there was not room for coal storage; (2) that there was not sufficient water available; and (3) that the dust would be a nuisance. The Corporation suggested that another expert should be called in. A resolution was ultimately carried "that the Tynwald approve of the Corporation raising a sum of £42,650, and that the question of the erection of further plant be deferred until further information be obtained from an expert nominated by the Governor at the cost of the Insular Government."

Leave was given the Corporation to supply electricity to an area two miles outside the town boundaries, including Onchan, Braddan, and Marown.

East Ham.—STREET LIGHTING.—The Corporation Works Committee has recommended that the existing 300-W lamps on main roads be changed for 150-W lamps and that additional 150-W lamps be installed on all remaining standards which are now without lamps.

Guildford.—SYSTEM OF SUPPLY.—In connection with the erection of the new generating station now in progress, the consulting engineer to the Guildford Corporation reports that it is necessary that the pressure of supply under that system should be formally fixed. He therefore recommends that the a.c., 3-phase, 50-cycle system be declared at 230 V between phase and neutral, and 400 V between phases. When the new system is put into operation the supply to the parish of Shalford, which is now a.c., single-phase, 50 cycles at 220 V, will have to be changed over. In order that the Corporation should be in a position, as circumstances permit, to develop the 3-phase a.c. system in any other part of the area of supply, it is desirable that powers should be obtained to change any parts of the existing 220/400-V, d.c. supply to the new system. The Electricity Committee has decided that application shall be made to the Electricity Commissioners accordingly.

LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to a loan of £14,700 for the installation of converting plant at Onslow Street central sub-station.

MAINS EXTENSIONS.—The Committee is to extend the mains to Burnham housing estate, at an estimated cost of £1,126.

Iceland.—WATER POWER.—The extensive water-power resources of Iceland have recently attracted the attention of foreign capitalists, and preliminary work has been done with a view to the industrial exploitation of some of the most important waterfalls on the island. Norwegian, Danish, German, and English interests have been very active in Iceland since the war, and several concessions have been granted, including a notable one to the Dansk-Islandsk Anlaegsselskab for the exploitation of waterfalls in the Vestfjord. Another concern has for some time been investigating the possibility of the exploitation of certain other falls for the production of saltpetre, and is at present negotiating with the Iceland Government for a concession to exploit one of the largest waterfalls on the island.

Knaresborough.—TRANSFER OF UNDERTAKING.—The Urban District Council has decided to transfer its electricity undertaking to Harrogate Corporation, which has agreed to pay all outstanding capital liability, and revenue liability, and to place Knaresborough consumers on the same basis as the Harrogate consumers. The purchase figure is approximately £13,000. In addition Harrogate will take over the entire electricity staff.

Leeds.—CABLE SUBWAYS.—The Corporation has arranged for the various committees to consider the question of the construction of subways for mains, cables, &c., with a view to the avoiding the constant breaking up of highways.

LOAN.—The Electricity Committee is applying for sanction to a loan of £10,000 for assisted wiring installations.

Liverpool.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £145,000 for the erection of buildings and civil engineering works at the Lister Drive power station.

NEW SCALE OF CHARGES.—The Corporation has approved the following new tariff for the districts of Waterloo, Seaforth, and Great Crosby:—Flat rate for power (including heating and cooking) up to 3,000 kWh per annum, 2d. per kWh; 3,000 to 10,000 kWh, 1½d.; and over 10,000 kWh, 1d. Maximum demand system: For power a fixed quarterly charge of £1 10s. per kW of the maximum demand and 0.4d. per kWh, plus the present increase of 25 per cent.

London.—BATTERSEA.—The London Power Co. has applied for sanction to erect a power station on a site about 15 acres in extent on the south bank of the River Thames, and is to purchase 3½ acres from the Metropolitan Water Board at a cost of £175,000.

BERMONDSEY.—The Electricity Committee has received sanction to the borrowing of £22,000 for mains and services, £5,000 for meters, and £10,000 for wiring installations.

ST. MARYLEBONE.—The Borough Council has received a communication from the Electricity Commissioners regarding its scheme for plant extensions and further bulk supply, in which they state that they propose to defer further action for six months.

FULHAM.—The Electricity and Lighting Committee has recommended to the Borough Council that a new sub-station be erected in Barclay Road in substitution for the Granville Road sub-station and fitted with the necessary transformers, switchgear, &c., at an estimated cost of £8,100.

Maidstone.—NEW PLANT.—The Town Council has applied for sanction to a loan of £60,247 for extensions to the steam raising and generating plant at the electricity works.

ASSISTED WIRING SCHEME.—It has been decided to put into operation a scheme for the assisted wiring of premises, and to apply for sanction to a loan of £3,000 for this purpose.

Maldon.—ELECTRICITY SUPPLY.—The Rural District Council has consented to an application by the Colchester Town Council to extend its area of electricity supply so as to include Tollesbury, Tolleshunt Knights, Tolleshunt D'Arcy, and Tolleshunt Major.

Manchester.—PROGRESS DURING FEBRUARY.—During the month of February the Corporation electricity undertaking showed an increase in connections of 2,534 kW, bringing the total to 304,468 kW; and the number of applications received for supply, including consumers for additional supplies, was 927, representing a total of 2,178 kW. The number of hired cookers connected increased by 129, bringing the total actually on circuit to 2,917. Applications for the hire of cookers totalled 101. A new 150-kVA transformer was put into commission at Nuthurst sub-station.

New Zealand.—AUCKLAND.—According to the *Electrical Engineer of Australia and New Zealand*, when the Arapuni hydro-electric station comes into operation next year, the greater portion of the Auckland Power Board's supply will be purchased from this source, and preparations are now being made for taking the larger supply. At present energy is transmitted from Waikato at 50,000 V to a Government sub-station at Penrose, where it is stepped down to 6,600 V for supply to Auckland. The new supply will be conveyed to Penrose at 110,000 V over three circuits, one of which is now operating at 50,000 V, while the other two are under construction. At Penrose the supply will be stepped down to 22,000 V for the Auckland Power Board, while there will also be a transformation to 50,000 V for transmission to the Waitemata Power Board. The Penrose sub-station at present accommodates a bank of transformers of 15,000-kVA capacity, 50,000/6,600 V. The building is being extended and two additional 15,000-kVA banks of transformers are to be installed. The transformers will step down from 110,000 to 22,000 V. In addition there will be another bank stepping up from 22,000 to 50,000 V for the Waitemata supply. A 10,000-kVA synchronous condenser will be installed to regulate the voltage. The Auckland Board purchases its bulk supply at the sub-station and is making preparations to convey it to the city by 22,000-V underground cables, an order for which has been placed. In addition to the power cables there will be a 12-core pilot cable for protective purposes. The work of opening up a trench to lay these cables has already been commenced.

Plymouth.—LOAN.—The Town Council, on April 4th, approved a recommendation of the Electricity Committee that application be made for sanction to borrow £20,996 for electricity extensions. It was reported that an additional 3-phase h.p. feeder cable should be provided from the electricity works at Prince Rock to St. Budeaux, in order to meet the increasing demand in the Swilly and St. Budeaux districts, and to complete a ring main for the greater security of the supply throughout the district, in which there are now over 1,870 consumers.

Preston.—MAIN EXTENSION.—At a cost of £2,235, the Corporation Electricity Committee proposes to extend the main in Tag Lane, Cottam.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Maidstone.—**Lighting of business premises: From 7½d. to** 7d. per kWh. First charge under the "telephone" system from 8s. to 7d. 4d. per 30-watt lamp.

Leyton.—**The temporary increase of 10 per cent. has been** removed.

Blackpool.—The increase of 10 per cent., imposed during the coal dispute, has been withdrawn.

South-East Lancashire Electricity Advisory Board.—New Transmission Line.—The Engineering Advisory Committee has recommended the Board to sanction the laying of a third 33,000-V main transmission line between Barton and Hill Top by the Lancashire Electric Power Co.

Special Order.—The Board has considered the application of the Altrincham Electric Supply, Ltd., for a Special Order to extend its area of electricity supply so as to include parts of the urban district of Altrincham and the rural district of Bucklow, and has resolved to defer expressing an opinion until the Central Electricity Board's scheme is made clear.

Power Station Extension.—The Committee has received an application from Altrincham Electric Supply, Ltd., for approval to the extension of its power station by one 6,000-kW turbo-alternator, and one additional 40,000 lb. water-tube boiler, with accessories, at an estimated cost of £44,615. The company reports that the Manchester Corporation's estimate for a duplicate main from Barton to Altrincham for a bulk supply is £100,000, to which would have to be added £33,284 for a sub-station with transformers and switchgear. Consideration of the matter has been deferred.

Bury Power Station.—The Bury Corporation has applied for sanction to install a 50,000-lb. boiler, together with economiser, stoker and chimney, at a cost of £14,800, to meet the requirements of 1927-28, and the replacement of certain existing plant by two 60,000-lb. boilers and one 10,000-kW turbo-alternator at an estimated cost of £99,000, to meet future requirements. The committee has recommended the Board to approve the boiler extensions required for the winter of 1927-28, and to adjourn consideration of the further extensions.

Fringe Orders.—The commitee has also recommended the Board to approve the application of the Cheadle and Gatley Urban District Council for a Fringe Order to supply electricity to certain premises outside its area.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Southport.—Electricity Supply.—Extensions to the Corporation generating station having become necessary, information has been furnished the Electricity Commissioners as to the cost of a bulk supply from Preston or Liverpool, and the cost of local generation. It is hoped to obtain powers for extensions to the power station.

Assisted Wiring Scheme.—The assisted wiring scheme referred to in our issue of March 1st, p. 435, has now been approved by the Town Council.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by Mr. W. T. Warren for the supply of electricity in the urban district of Brightlingsea and the parish of Thorrington, and the Urban District Council of New Mills to supply electricity in its area.

Torpoint (Cornwall).—Power Station Fire.—A fire broke out at the local electricity works on April 7th. It started in a building containing the engine, and some oil tanks became ignited.

York.—Electricity Charges.—The Corporation Electricity Committee has fixed the following scale of electricity charges:—Lighting: Flat rate, private lighting, 4½d. per kWh. public houses, &c., 3½d. per kWh; maximum demand, 7d. and 1½d. per kWh; rateable value, 15 per cent., plus ½d. per kWh. Power: Varying from 1½d. per kWh for 1,000 kWh per quarter to ½d. per kWh for over 10,000 kWh per quarter.

Electricity Supply.—The Electricity Committee is to extend feeders at a cost of £9,000 and to renew mains at a cost of £2,750.

Tramway and Railway Notes.

Blackburn.—Fares.—At a meeting of the Town Council, on April 7th, a recommendation to reduce all fares within the borough to 1½d. was discussed. Ald. Higham criticised a motion for penny fares, and said it would mean a loss of £10,000 per year. The proposal to introduce penny fares was defeated by a large majority, and the recommendation for 1½d. fares was adopted.

Bradford.—Railless Cars.—The Estimates Sub-Committee has approved expenditure proposed by the Tramways Committee for the purchase of 10 new railless cars and additional overhead equipment, for the extension of the Oakenshaw-Ordsal railless-car service to the centre of the city.

Continental.—Hungary.—The Vienna correspondent of the *Daily Mail* reports that the English Talbot financial group's contract with the Hungarian Government for electrifying the railway trunk line from Budapest to Hegyeshalom, on the Austrian frontier, includes 55 electric locomotives and a power plant with a capacity of 75,000 kW. The Government reserves the option to cancel the contract before June 30th if unforeseen difficulties arise. This railway electrification will make Hungary almost independent of foreign supplies of coal. The contract has been awaiting the Commerce Minister's signature for several months, and this has now been obtained.

Holland.—Good progress is being made with the electrification of the Dutch railways. Electric trains are about to commence running between Haarlem and Rotterdam and between Haarlem and Ymuiden, and it is expected that the electrification of the Amsterdam-Rotterdam line will be completed by October next.

Switzerland.—The first of a new and improved type of electric locomotive has just been completed at the Brown, Boveri works at Munchenstein for hauling heavy express trains between Berne and Zurich. The engine, which runs on seven pairs of wheels and weighs 115 tons, is stated to have attained a speed of 62½ m.p.h.

Austria.—The work of electrifying the first stretch of the second section of the State Railways has recently been completed, and electric trains are now running between Woral and Innsbruck, a distance of 45 miles.

Egypt.—Railway Electrification.—It is announced that the necessary funds for the electrification of the Cairo-Helouan railway are to be provided in the Egyptian Government's Budget for 1927-28.

Hull.—Track Renewal.—The Corporation Tramways Committee is to reconstruct the track at Newland Avenue, at an estimated cost, including rails and accessories, of £11,300.

Japan.—Railless Cars.—Mr. G. Yamane, of the Yamaguch Prefectural Assembly, proposes to introduce a railless-car service between Ogi station and Koshigahama, a distance of five miles.

It is proposed to form the Inari Muki Densha K.K. for the purpose of running a railless-car service between Mito and Kasama Shrine, a distance of 13 miles.

Another railless-car scheme is proposed in Totte-machi, in the Ibaraki Prefecture, which will be 30 miles in length. The Kokuso Mukijo Densha K.K. is being formed at Soma-machi for this purpose.

Electric Railways.—New electric railways are to be constructed, and existing lines extended this year in the six Prefectures of Central Japan, which will increase the total mileage of electric railways by 241.

London.—Fares.—The Highways Committee of the L.C.C. has recommended that the 1s. daily tickets, at present in operation on the Council's tramway, be extended to local routes in East Ham, West Ham, and Walthamstow, on the same conditions as obtain on the Council's tramways, and that, as an experiment during the months of June to September, inclusive, 6d. daily tickets for children under 14 years of age, with the same availability as the 1s. tickets, be issued.

Telegraph and Telephone Notes.

France.—Speculation by Wireless.—According to the *Daily Telegraph*, for some time the official wireless research authorities in France have been puzzled about certain messages sent in code, but eventually direction-finding tests enabled them to locate an unregistered transmission station in a private house in the Rue de l'Assomption, Paris.

It is alleged that a group of financiers, having provided funds for the installation of this transmitting set, used it to send messages in code to stations in Amsterdam, Berlin, and certain places in Russia, where their agents, acting on their instructions, engaged in exchange operations. Summonses have been issued against five bankers and two wireless operators, who are to explain to an examining magistrate their reasons for the alleged infringement of the laws which subject wireless transmission to State control. The only charge against them at present is that they have robbed the State of revenue by sending eighty messages a day for several months without payment of any tax or licence fee.

Gibraltar.—Telephone Communication.—Telephone communication with Spain was established for the first time on April 4th in the presence of the Governor of Gibraltar, officials, the Spanish Consul-General, and representatives of the Spanish Telephone Company.—*Reuter* (Gibraltar).

Guernsey.—TELEPHONE STATISTICS.—The balance sheet and statistics for the year ended December 31st, 1926, relative to the State Telephone Department (engineer and manager, Mr. E. H. Bennett) show the gross revenue to have increased by £1,380 to £18,110, and the net profit (£762) to have been £487 greater than in the previous year. The total number of lines increased by 225 to 3,955, including 90 junction lines; the mileage of circuit wire overhead was 2,434, and underground 4,486, being increases of 49 and 558 miles respectively; the single wire mileages are double these figures. The number of switchrooms remained at five. The total number of calls increased by 75,909 to 2,393,121; trunk calls to and from Sark numbered 14,227. Telegrams and letters telephoned to the Post Office reached 22,954, an increase of 1,456. The staff, including 46 operators, increased by 2 to 85.

Submarine Telegraphy.—PROGRESS IN 1926.—The Bureau International de Telegraphie reports that during 1926 new submarine telegraph cables were laid between Bay Roberts (Newfoundland) and Plymouth (England); between Borkum (Germany) and the Azores; in the Pacific Ocean between Bamfield (British Columbia) and the Fiji Islands, and between the Cocos Isles and Australia.

Transatlantic Telephony.—NEW RECEIVING STATION.—The tuning-in of the first of the three three-mile long aerials of the new transatlantic telephone receiving station at Kemback, near Cupar, Fife, is now complete. Daily messages from the United States are received by the staff, which includes several American experts; reception is satisfactory, and the tuning of the other aerials will soon be complete; the three aerials radiate towards Denham, St. Andrews, and Pitscottie.

Radio Notes.

Lithuania.—STRICTER REGISTRATION.—The first sitting of the Exploitation Commission of the Kaunas wireless station was held recently to examine the activities of the station. Owing to lack of resources it has not hitherto been possible to develop; the number of registered subscribers in Lithuania at present is 1,500, of whom 1,000 are in Kaunas. Notwithstanding the regulations regarding the registration of apparatus, there are still many unregistered sets, it being estimated that the total number is 10,000. On the basis of the recent Cabinet decision, 75 per cent. of the receipts is assigned to programmes; the Commission therefore intends to introduce measures for the registration of all radio apparatus. Strict control will be enforced, and those who fail to register in time will be fined. Moreover, in shops dealing in wireless accessories, all apparatus and parts sold will be registered. It is proposed periodically to relay from the Kaunas station the more interesting programmes of the principal European stations.—*Reuter's Trade Service.*

New Continental Stations.—HUNGARY.—It is understood that the Radiotelefono Hirmond Co., of Budapest, is to build a 60-kW station similar to that at Langenberg; the scheme has the approval of the Hungarian Post Office authorities.

JUGO-SLAVIA.—A company has definitely obtained a licence for the erection of a transmitter of 6 kW. The company began its activities with a capital of 2,500,000 dinars, says *World Radio*. The station will be installed on the top of the Académie des Sciences at Belgrade.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ausralia.—MELBOURNE.—May 10th. Postmaster-General's Department. Telephone relays. (B.X. 3333.)*
May 17th. Resistances and reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*
May 9th. 6,600-V transformers and spares. (B.X. 3331.)*
July 5th. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*

SYDNEY. — May 9th. Electricity Department. Station auxiliary switchgear. (B.X. 3338.)*
April 26th. A.C. electricity meters. (B.X. 3407.)*

Barking.—May 9th. County of London Electric Supply Co., Ltd. Cables and accessories for the Barking power station. (April 1st.)

Bolsover.—April 19th. Urban District Council. Cables, boxes, pillars, &c. (April 1st.)

Clayton.—April 18th. Urban District Council. E.h.p. feeder cables, l.p. distributing mains, fuse pillars and transformer kiosk. (April 1st.)

Colombia. — BOGOTA. — April 30th. Ministry of Public Works. Two electric lifts. A.X. 4433.)*

Dartford.—April 22nd. Electricity Department. 2,098 yd. l.p. cable. (See this issue.)

Dublin.—April 30th. Electricity Department. E.h.p. and l.p. cables, cast-iron and stoneware troughing, section pillars, compound and other materials and accessories. (See this issue.)

Dundee.—April 18th. Tramways Department. Stores for a year, including armature and field coils, insulating tapes, lamps, &c. Specifications, &c., from Mr. Duncan P. Morrison, general manager.

Edinburgh.—April 18th. Electricity Supply Department. De-aerating plant and boiler feed pumps. (March 25th.)

Glasgow.—April 19th. Lighting Department. Materials, including electrical fittings, &c., for one year. Particulars from the office of Lighting Department.
April 23rd. Parish Council and District Board of Control. Stores, including electrical fittings and lamps, for six months. Forms, &c., from Mr. A. Reynard, inspector and clerk, 266, George Street, Glasgow.

Grimsby.—May 2nd. Electricity Department. E.h.p. and pilot cables; l.p. feeder cables. (See this issue.)

Ilford.—April 26th. Electricity Department. One 1,500-kW motor-convertor or rotary-convertor and transformer, 6,600-V switchgear cubicles and alterations to existing switchgear. (April 8th.)

India.—India Store Department. April 26th. 66-kVA motor-driven alternator sets, transformers, switchgear, &c. (April 1st.) Telephone cable. (April 8th.) 53,825 inert electric cells. (See this issue.)

London.—LONDON COUNTY COUNCIL.—April 22nd. Electrical installation at the Stonhouse Street elementary school, Clapham (approx. 167 points. (April 8th.)
April 26th. Wiring and fitting for electric lighting in two blocks of tenements at the Ring Cross housing estate, Islington (approx. 274 wiring points). (April 8th.)
G.W.R. April 21st. Stores, including electrical wires and cables and telegraph ironwork. (April 1st.)
ST. MARYLEBONE.—May 18th. Electricity Department. L.p. and e.h.p. cables for 12 months. (See this issue.)
METROPOLITAN ASYLUMS BOARD.—April 25th. Installation of electric lighting, telephone, fire alarm and domestic bells in the engineer's house at the Western Fever Hospital, Seagrave Road, S.W.

New Zealand.—WELLINGTON.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*
June 21st. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*
June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*
May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*
June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*
June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*
INVERCARGILL.—May 31st. Southland Electric Power Board. Transformers. (B.X. 3379.)*
June 15th. 66,000-V, oil circuit-breakers. (B.X. 3378.)*

Oldham.—April 30th. Electricity Department. Coal-handling and conveyor plant. (See this issue.)

Plymouth.—April 25th. Electricity Department. Electricity meters, cables, and transformers. (April 1st.)

South Africa.—JOHANNESBURG.—May 7th. Municipal Council. Electric street lamp fittings and globes. (B.X. 3395.)* Cables. (B.X. 3406.)*
CAPE TOWN.—June 1st. The University. Electric cooking utensils for the new residences at Groote Schuur. (B.X. 3393.)*

Southend-on-Sea.—April 19th. Light Railways and Electricity Department. 4,000 joint boxes. (March 25th.) 1,400 current limiters. (April 1st.)

Spain. — MADRID. — Ministerio de Fomento. Six electric cranes for the port of Alicante.

Stafford.—April 30th. Staffordshire Education Committee. Electric wiring and fittings for the new infants' department of the Slater Street Council school and in the additional class rooms, laboratory, &c., in the Salisbury Street central school. (April 8th.)

Uruguay.—Montevideo.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V, 50 cycles). (B.X. 3371.)*

Wrexham.—April 19th. Electricity Department. One 250-kW rotary-convertor equipment and d.c. switchgear. (April 1st.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Switchgear for two sub-stations and 12 kiosks (£5,136).—English Electric Co., Ltd.
One 100-kVA transformer (£117), two 200-kVA ditto (£384).—General Electric Co., Ltd. Three 500-kVA ditto (£1,149).—Hackbridge Electric Construction Co., Ltd.

Bradford.—Tramways Committee. Accepted:—
Ten 36-seater railless electric trolley cars (£14,012).—English Electric Co., Ltd.
24 pairs of manganese steel points (£2,340).—Hadfields, Ltd.
30 tons cast-iron brake blocks (£292).—Yorkshire Repetition Castings Co., Ltd.

Brecon.—Town Council. Accepted:—
Plant, &c., in connection with the electricity scheme: Plant (£4,667).—Petters, Ltd. Battery and accumulators (£1,665).—Chloride Electrical Storage Co., Ltd.

Canterbury.—Town Council. Accepted:—
Automatic switchgear at £2,845.—A. Reyrolle & Co., Ltd.

Cheltenham.—Electricity Committee. Accepted:—
Cables for Cleeve Hill extension (£2,087).—British Insulated Cables, Ltd.

Dover.—
Installation of electric lighting, heating and power in the garages, workshops, &c., of P. J. Niblett & Son.—J. L. Etheridge & Co.

Hatton, near Warwick.—Warwickshire County Mental Hospital. Consulting engineer: Mr. A. B. Mallinson.
Boilers, mechanical stokers, feed pumps, &c. (£4,200).—H. & T. Danks (Netherton), Ltd.
Two 75-kW Belliss-G.E.C. engines and dynamos and one 35-kW ditto (£1,813).—G. N. Haden & Sons, Ltd.
Main switchboard (£445).—Erskine, Heap & Co., Ltd.
Storage battery and booster (£1,338).—Chloride Electrical Storage Co., Ltd.
Electric wiring (£6,693).—J. Collier & Co., Ltd.
Electric motors and tools (£994).—G. N. Haden & Sons, Ltd.
Heating and hot-water services (£7,343).—G. N. Haden and Sons, Ltd.
Complete laundry equipment, with dryers and calender (£3,118).—T. Bradford & Co., Ltd.

Hull.—Baths Commitee. Accepted:—
Electrical wiring and fittings at vapour and electrical baths:

Miller & Garness	£120
H. Hyde & Co.	117
James V. Coonan Co.	109
A. Shaw & Sons	106
King & Co., Ltd.	99
City Electric Co.	97
J. Wright	96
Clark & Graham	92
Wm. Broady & Son. (Accepted.)	**90**
City Engineer's estimate	110

London.—L.C.C. Education Committee. Recommended:—
Wiring and fittings at Drayton Park school, Islington:—

A. Shaw	£275
Bailey & Incledon, Ltd. (Recommended.)	**290**
Anderson, Angell & Co.	294
Alpha Manufacturing & Electrical Co., Ltd. ...	315
A. Meckhonik	325
Pinching & Walton	338
P. M. Braidwood	348
R. Hunt & Co., Ltd.	355
Smith & Hammond, Ltd.	360
A. Hawkins & Sons	392
City Electrical Co.	397
L. G. Tate & Co., Ltd.	408
G. Hopkins & Sons (Clerkenwell), Ltd. ...	450
Dalziel Engineering Co.	543

Metro-Vick Supplies, Ltd., has received contracts for the supplies of electrical accessories, &c., from the Islington, Paddington, and Stepney Boards of Guardians.

War Office.
Receiving, transmitting and rectifying valves.—Edison Swan Electric Co., Ltd.

Hull.—Tramways Committee. Accepted:—
Extension Hessle Road tramways (£3,330).—Sangwin, Ltd.

Lamp Contracts.—Metro-Vick Supplies, Ltd., has received a 12 months' contract for "Cosmos" lamps, &c., from the London & North-Western Railway Co. The North-Eastern Railway Co. has placed contracts for 12 months' supplies of electric lamps with the British Thomson-Houston Co., Ltd., and Siemens & English Electric Lamp Co., Ltd. Edison Swan Electric Co., Ltd., has received a contract for electric lamps from the London, Midland & Scottish Railway Co. Hull Corporation Tramways Department has placed a 12 months' contract for carbon and metal-filament lamps with Siemens & English Electric Lamp Co., Ltd.

Leeds.—Tramways Committee. Accepted:—
Track reconstruction, Woodhouse Lane (£640).—J. Speight.
Two pairs points, chrome steel, for experimental purposes (£150).—Thermit, Ltd.
Two lay-outs (£1,030), six pairs points (£726), eight crossings (£232).—Edgar Allen, Ltd.

Lichfield.—Town Council. Accepted:—
Electrification of a set of pumps at the Trent Valley Pumping Station (£101).—J. Richards & Co.

Liverpool.—Electric Power and Lighting and Tramways Committee. Accepted:—
Twelve months' supply of electricity meters.—Ferranti, Ltd.
Cables and accessories for street mains.—W. T. Henley's Telegraph Works Co., Ltd.; Callender's Cable and Construction Co., Ltd.; Dussek Bitumen Co., Ltd.; Penmaenmawr and Trinidad Lake Asphalte Co., Ltd.
Insulated cables.—Liverpool Electric Cable Co., Ltd.; Mersey Cable Works, Ltd.
One electrically-driven traverser for the Edge Lane car works (£409).—S. H. Heywood & Co.
Circulating-water, suction and discharge pipes for Lister Drive (£5,792).—Staveley Coal & Iron Co., Ltd.
H.p. switchboards for sub-stations.—Ferguson, Pailin, Ltd. (£10,805); Metropolitan-Vickers Electrical Co., Ltd. (£26,565).
Additional switchgear (£44,405).—Metropolitan-Vickers Electrical Co., Ltd.

Manchester.—Baths Committee. Accepted:—
Installation of electric lighting at Pryme Street baths.—R. H. Clampett & Co.
Housing Committee. Accepted:—
Installation of electricity at houses on various estates.—J. W. France & Co.; S. Dickinson; Fletcher and Turley; and Hanchett, Barratt & Currie.
Electricity Committee. Recommended:—
Cable.—Standard Telephones & Cables, Ltd.; and British Insulated Cables, Ltd.
Renewal of turbine blades at Stuart Street sub-station.—Richardsons, Westgarth & Co., Ltd.
1,500-kW motor-convertor.—Ateliers de Constructions Electriques de Charleroi.
750-kW motor-convertor.—British Thomson-Houston Co., Ltd.
Weldless steel lamp columns and fittings.—British Mannesmann Tube Co., Ltd.; and the Bromford Tube Co., Ltd.
33,000-V switchgear.—British Thomson-Houston Co., Ltd. 420-V ditto.—Metropolitan-Vickers Electrical Co., Ltd.; and 240-V ditto.—Whipp & Bourne, Ltd.

At the meeting of the City Council on Wednesday last week, Ald. Dagnall, chairman of the Electricity Committee, drew attention to the recommendation of the Committee to accept the tender of the Ateliers de Constructions Electriques de Charleroi for a 1,500-kW motor-convertor, switchgear, &c., for the Ancoats sub-station at £4,090. Three British tenders have been received for the same specification. The prices of the English firms were all within £1 and less, and they were 25 per cent. higher than the Belgian quotation. The lowest suitable British tender was £5,045 6s., the others being £5,045 10s. and £5,046. The chairman of the Electricity Committee, after giving these figures, said the Committee thought it time to let the British manufacturers know that while it was prepared to pay a good price and prices commensurate with the value of the machine, it was not going to pay artificial prices. The decision of the Council to give the contract to the Belgian firm was unanimous.

Preston.—Electricity Committee. Recommended:—
Duplicate of No. 3 generating set (£48,000).—English Electric Co., Ltd.

Oldham.—Electricity Committee. Accepted:—
Cable.—Union Cable Co., Ltd.
Education Committee. Accepted:—
Re-wiring and encasing electric mains at Clarksfield School. S. Charlesworth & Co.

Rotherham.—Town Council. Accepted:—
Three railless electric vehicle chassis (£995 each).—Clough, Smith & Co.
Three bodies (£520 each).—Charles H. Roe, Ltd.

South Africa.—CAPE TOWN.—Accepted:—
Rewiring the Mount Nelson Hotel for a 220-V supply (£5,560).—E. A. Shaw & Co. (Cape Town).

Wallasey.—Electricity Committee. Recommended:—
12,500-kW turbo-alternator (£38,345).—English Electric Co., Ltd.
Two boilers (50,000 lb. per hour normal rating) and auxiliary plant (£46,840).—Simon Carves, Ltd.

Wimbledon.—Electricity Committee. Accepted:—
Two 10,000-V switch panels (£607).—A. Reyrolle & Co., Ltd.

Forthcoming Events.

Electrical Power Engineers' Association (Glasgow Section).—Friday, April 15th. Reed's Restaurant, Glasgow. 7.30 p.m. "X-Ray Plant and Practice." Mr. W. S. Weir.

Institution of Electrical Engineers.—Thursday, April 21st. London. 6 p.m. Kelvin Lecture, "High-frequency Currents." Prof. E. W. Marchant.

(Sheffield Sub-Centre).—Wednesday, April 20th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Some Magnetic Problems." Mr. A. Tustin.

(Tees-Side Sub-Centre).—Monday, April 18th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Annual general meeting.

Birmingham Electric Club.—Friday, April 22nd. Grand Hotel. 7 p.m. "Radiation Effects." Mr. J. B. Kramer.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, April 23rd. Durham. 3 p.m. "Accumulators (Lead-type)." Mr. A. W. Bridges; and "Electrical Testing Gear for Collieries." Mr. H. J. Fisher.

Notes.

Electrical Association for Women.

About 80 members of the above Association visited the new Tricity Restaurant, Strand, on April 6th, when Mr. A. F. Berry gave a very interesting talk on the history of the development.

At the last of the series of E.A.W. evening lectures, on April 6th, Mr. J. W. Beauchamp, Director E.D.A., spoke of the work which women are doing in the American electrical industry; a very interesting discussion followed.

Appointments Vacant.

Charge engineer for the East Sussex County Mental Hospital, Hellingly. Engineer-in-Chief for the County of London Electric Supply Co., Ltd. Two shift engineers for the Penang Municipal Commission. Inspectors for the Lift and Crane Department of the National Boiler and General Insurance Co., Ltd. City electrical engineer (£1,500), for the City of Salford Electricity Department. (See our advertisement pages to-day.)

The Largest Diesel-Electric Ship.

A contract was placed in March last with Scotts' Shipbuilding and Engineering Co., Greenock, by the Atlantic Refining Co., of Philadelphia, U.S.A., for an oil tanker of 12,500 tons deadweight. The vessel will be the largest in the world employing Diesel-electric propulsion; her length will be 469 ft., beam 63 ft., and moulded depth 36 ft. 9 in. The designed speed is 11 knots, and the oil engines driving the dynamos are to be of the Carels-Ingersoll-Rand four-cycle airless-injection type, built by the Carels firm (S.E.M.) in Ghent, Belgium. There will be four units of 750 b.h.p., each having six cylinders and running at 225 r.p.m. Each engine will drive an auxiliary generator of 75 kW mounted on the same shaft. The electrical machinery will be supplied by the British Thomson-Houston Co., Ltd., Rugby, and four 250-volt dynamos will run in series, supplying one 1,000-volt main propelling motor of the double-armature type, rated at 2,800 s.h.p. at 95 r.p.m. The auxiliary machinery will only require 1½ per cent. of the total horse-power installed.

The cargo pumps will be of the rotary displacement type, each coupled to an 80-h.p. electric motor installed in the engine-room and operated by remote control from the pump-room. The machinery will be controlled from the pilot house, and a gyroscopic compass is to be fitted. The Atlantic Refining Co. owns the largest fleet of Diesel-electric vessels in service, as there are five, the largest being the *J. W. Van Dyke*, with a capacity of 7,500 tons deadweight. The owners are now converting three additional tankers to Diesel-electric drive, each of which will be equipped with three 600-b.h.p. Ingersoll-Rand engines.

The *Motor Ship* also reports that the *District of Columbia*, which has been purchased by the Standard Oil Co., California, for conversion, will be equipped with four 1,000-h.p. Busch-Sulzer engines coupled to dynamos and running at 275 r.p.m. The vessel is a tanker of 7,641 tons gross, built in 1921, and she has a tank capacity of 83,146 barrels. The Parsons geared turbines originally installed developed 2,800 s.h.p. at 90 r.p.m., and gave a speed of 10 knots. Each of the new Diesel engines will drive a 700-kW d.c. generator supplying a double-armature propelling motor rated at 3,200 b.h.p. at 90 to 105 r.p.m. Excitation for the generators will be supplied from two 175-kW machines directly connected to the wing Diesel engines. The electrical plant is of the Westinghouse type. Auxiliary power in port will be obtained from a 60-kW generator, except when cargo is being handled, when one of the main generators will be run. All the deck equipment will be electrically operated.

A Week-End Engineering Conference.

The Manchester Engineering Council has organised a week-end engineering conference for employers and employés in the industry from April 22nd to 24th, inclusive. It is to be held at the University, Manchester, and will be opened with a public meeting in the Whitworth Hall, on Friday evening, April 22nd, at 7 p.m. The Lord Mayor and the President of the Council (Mr. L. E. Mather, chairman of Messrs. Mather and Platt, Ltd.) will hold a reception, followed by a public meeting, when Messrs. W. L. Hichens and W. M. Citrine (Electrical Trades Union) will open a debate on "Economic Production." The subjects for Saturday will be the "Future of Industry" (Mr. J. Rowan, of the Electrical Trades Union, presiding); "Arbitration in Industry"; and "Aspirations of Trade Unions" (Mr. S. Mavor in the chair). On Sunday morning Mr. E. J. Fox will speak on "Works Committees" (with Mr. C. G. Renold in the chair), while after luncheon Mr. Mather will sum up the proceedings and a service at the Cathedral will follow.

The Council was founded in 1918, and it has, as a result of its activities during nine years, secured a membership of 650. We learn from the honorary secretary, Mr. Gerald Webb (c/o Messrs. Mather & Platt, Ltd., Park Works, Manchester) that the movement has been well supported by prominent employers and trade union leaders in the district, and the average attendance at its ordinary monthly meetings is 250, drawn from all ranks of the industry, including shop workers. The Council is anxious that districts other than Manchester should be well represented, and we recommend employers, foremen, and trade unionists to communicate with Mr. Webb. We have attended many conferences which have been more or less representative of the different parties interested in industry, but discussions have often lacked an atmosphere of reality and seriousness, and we welcome the assurance that the present joint gathering of the engineering industry is such a one as has never before taken place. We wish the organisation every success, and shall watch the movement with interest and sympathy.

Cheap Electricity.

"Cheapest Electricity—How to Obtain It!" is the title of a brochure recently received from Messrs. Ruston & Hornsby, Ltd., of Lincoln, who introduce it as the considered opinion of an independent electrical engineer who is concerned only with the problem of cheap power supply. In effect it is a criticism of the Electricity Supply Bill (now an Act) on the basis of the relative costs of production in large and small stations. For this purpose the working costs and capital charges of a number of stations in each class are compared, and it is shown that while the large steam station can show a small economy over the oil-engine station at the bus-bars, this advantage is lost at a radius of six or seven miles owing to the capital charges on the transmission lines. The cost of transformation further handicaps the big station. It is suggested that the expenses of the Central Electricity Board will be out of proportion to the economy effected by centralisation of plant, and that bulk supply will have to be very cheap to justify the conversion of a small station into a distribution centre. As regards the small power user, he can generate electricity for himself with oil-driven plant so cheaply that it is difficult to secure him as a customer of the electricity works, and the elimination of the air-compressor by the use of cold-starting solid-injection engines reduces the capital cost, the risk of breakdown, and the cost of maintenance; actual experience shows that the fuel cost at 0.7 lb. of oil per unit generated, with fuel oil at 85s. per ton, is only 0.32d. Supplementing the article, the publishers give certified figures of running costs obtained in practice, showing that in one case where the cost per unit generated (excluding capital charges) was 0.614d., the owners (Crittall Manufacturing Co.) saved nearly £3,000 a year by substituting oil for coal. At another factory the plant cost £3,542 and generated 176,390 kWh per annum, at an inclusive cost of 1.43d. per kWh; and at a foundry where half this output was produced, the annual saving compared with the cost of public supply was £635—sufficient to pay for the plant in a little over two years. There is no doubt that public electricity supply undertakings must offer very low tariffs if they wish to compete with these small installations, which, though working at a load factor apparently much less than 20 per cent., show such low costs.

The I.E.E. Wiring Regulations.

We are indebted to the courtesy of the general secretary of the Association of Supervising Electrical Engineers for an advance proof of an article that will appear in the April issue of the Association's journal, *Contact*, with regard to the I.E.E. Wiring Rules. It is stated that in November, 1924, the Board of Control of the Association set up a special committee to examine the eighth edition of the Rules, which was issued in June, 1924, and on February 2nd, 1925, the Board submitted proposed amendments and suggested that an abridged version should be issued for the use of wiremen; in reply, the I.E.E. Wiring Rules Committee asked the N.A.S.E. to prepare one and submit it for consideration. This was quickly done, and on August 26th, 1925, the completed suggestions were delivered to the I.E.E. Thereafter nothing happened until May 4th, 1926, when the N.A.S.E. was informed that the I.E.E. Committee was "still waiting to receive the proposals of the Electrical Contractors' Association," which also wished to submit suggestions for an abridged copy. On February 25th, 1927, a printed abstract of the Regulations was submitted by the E.C.A. to the Committee; the N.A.S.E. representative claimed that as it was first in the field, its version should be dealt with first, and as certain items in the E.C.A. booklet which the I.E.E. Committee could not accept were absent from the N.A.S.E. proposals, the E.C.A. and the N.A.S.E. agreed to confer on the subject. In the meantime the I.E.E. Committee has decided to publish immediately a ninth edition of its Regulations, and the Association of Supervising Electrical Engineers (formerly N.A.S.E.) is examining the E.C.A. booklet and its own version in the light of this decision. It is urged that the abridged copy should be published on the authority of the Institution of Electrical Engineers, rather than that other authorities should issue their own abridgements. "The sooner the abridged edition is an accomplished fact the sooner will there be general adoption of the Regulations and efficient standards."

The last sentence suggests that the Regulations have not secured general adoption. It would be interesting to know the percentage of installations carried out during 1925 and 1926 in full compliance with them.

Irish Free State Electricity Supply.

Considerable indignation is manifest throughout the Irish Free State at the decision of the Government to take over control of the municipal and other electricity undertakings in the State and to work them in conjunction with the Shannon hydro-electric scheme.

During the Committee stage of the Electricity Supply Bill in the Dail Eireann, strong protests were made against the proposal, which was described as confiscatory, immoral, and economically unsound, more particularly as the Minister for Industry and Commerce (Mr. P. MacGilligan) announced that no compensation would be paid to the owners of existing municipal undertakings. Mr. John Good, a member of the Dail, spoke of the Government's attitude as that of wiping out valuable vested interests built up at the expense of the ratepayers, and instanced the case of Dublin, where the Corporation had achieved great success with its electricity undertaking and had given great satisfaction to all classes of the citizens by its electricity supplies for power, heating, and lighting.

The Minister's arguments that municipal authorities should not make big profits, and that using the profits of an electrical undertaking to relieve the rates was not viewed with favour by the Government, created much surprise. The Dublin undertaking cost £1,300,000, which, he said, had been paid by the electricity consumers, and if the Corporation was given compensation it would mean that the ratepayers would receive a further gift from the consumers. An amendment to the effect that compensation be provided for was, after discussion, rejected by 43 votes to 11.

Since then, some of the leading electrical experts in Dublin and elsewhere have joined in the protest against the confiscatory bearing of the Bill: in one quarter the proposal is bluntly referred to as "barefaced robbery," and in others it is feared that the result will be injurious to the Shannon scheme and may lead to serious complications in its operation and in the distribution of electricity. The scale of compensation, it is urged, could be drawn up on the basis of the market value of each undertaking, thus recognising the importance of the achievements of the local authorities and companies and private owners during a long series of years. There appears, however, to be little hope that the Minister will change his mind.

Mr. MacGilligan announced that he saw no reason why the distribution of electricity from the Shannon should not begin in February, 1929. He believed that the annual consumption then would be 75,000,000 units, and that this would be increased to 110,000,000 units in 1932, in which year it was expected the Board of Control would be able to pay the sinking fund and meet all working expenses out of revenue. He accepted an amendment under which electricity could be supplied from the Shannon scheme to consumers in Northern Ireland.

Major Bryan Cooper protested against the tendency on the part of the Minister not to give information called for by the House, remarking that at times one would think the Shannon scheme was the Minister's private property and that it was an impertinence on the part of the Dail to ask for details.

Civil Service Commission.

Regulations and particulars for the forthcoming examinations for probationary assistant engineers and probationary inspectors in the Engineering Department of the Post Office can be obtained from the Secretary, Civil Service Commission, Burlington House, W., together with the form on which application must be made. The latest dates for the receipt of application forms are July 14th and 28th respectively. (See our advertisement columns to-day.)

Boiler Explosion Report.

We have received a copy of the report on a preliminary inquiry into the cause of the explosion of a water-tube boiler at the London County Council's tramway power station at Greenwich in September last. The clamp retaining one of the header caps at the back of the boiler fractured around the bolt head, allowing the cap to be forced off and the contents of the boiler to escape. A crack appears to have formed in the clamp and gradually developed until the section of material left was insufficient to resist the stress imposed upon it.

Reinforced Concrete.

A booklet entitled "The Relative Value of Mild Steel and High-tensile Steel in Reinforced Concrete Construction," containing correspondence between Mr. H. Weston (of the Weston Concrete Engineering Co., Ltd.) and the Ministry of Transport, and reports on the subject by eminent experts, leads to the conclusion that the grade of steel used for reinforcement is of no importance; once a crack is formed it will soon reach the surface of a slab, whatever the kind of reinforcement.

The Budget.

Mr. Winston Churchill, the Chancellor of the Exchequer, introduced his Budget on Monday last. In the changes of taxation which he announced there appears to be nothing of direct electrical interest. The part of his speech likely to concern our readers was that relating to the disappearance of three departments—the Ministry of Transport, the Mines Department, and the Department of Overseas Trade. In Mr. Churchill's own phraseology, the Ministry of Transport is to be abolished as a separate department; the functions of the Mines Department are to be distributed; and the separate existence of the Department of Overseas Trade is to be terminated. No direct reference was made regarding the future of the Central Electricity Board and the Electricity Commissioners; presumably these will come under the *ægis* of the Board of Trade.

The Batti-Wallahs' Society.

On Tuesday, April 26th, at a luncheon at the Hotel Cecil, London, Sir Arnold B. Gridley, K.B.E., M.I.E.E., will deliver an address on "How to Reconcile Relations between the Consumer, the Producer, and the Wage-earner."

Educational.

Northampton Polytechnic Institute, Engineering Day College.—The entrance examination in connection with the Engineering Day College will be held on Tuesday, April 26th. Further information can be obtained on application to the Principal. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

North-Western Centre.—The annual meeting of the North-Western Centre of the I.E.E. was held on April 5th, at Manchester, Mr. W. J. Medlyn presiding. The report of the Committee showed that the aggregate membership was 1,103, made up of 112 members, 440 associate members, 12 associates, 149 graduates, and 390 students. Compared with last year, there was a decrease of 37 in the number of students, and increases of 2 members, 23 associate members, and 23 graduates, the net increase being 11. The chairman announced that Mr. Ratcliff, who, in the ordinary course, as senior vice-chairman, would have become the chairman of the Centre this year, did not wish to do so. Mr. Lunn, the hon. secretary, found that pressure of business compelled him to give up the position, and the Centre was to lose Mr. Watson, who had been appointed chief engineer of the London and Home Counties Electricity Authority. The election of officers resulted as follows:—*Chairman*: A. B. Mallinson; *vice-chairmen*: W. J. Wood and T. E. Herbert; *hon. secretary*: J. D. Peattie; *new members of the committee*: Messrs. O. Howarth, H. Hawkins, G. A. Juhlens, A. L. Lunn, and Cobden Turner.

North-Western Students' Centre.—On Tuesday last, at the annual general meeting of the Students' Centre, an address was to be given by Mr. J. A. Robertson, M.I.E.E., on "The Electricity Supply Act, 1926—and After." The nominations for election of committee, to take place at the meeting, included the names of Mr. G. R. Millward (hon. secretary) to be chairman, and Mr. W. L. England to be vice-chairman of the Centre.

Institute of Metals.

At a general meeting to be held on May 11th, the seventeenth annual May Lecture will be delivered by Sir Henry A. Miers, F.R.S., on "The Growth of Crystals in Supersaturated Liquids."

The Faraday Society.

On April 22nd and 23rd a general discussion is to take place on the theory of strong electrolytes, at the University Museum, Oxford, under the chairmanship of Prof. C. H. Desch. Some 24 papers are to be submitted. Admission will be by ticket. The annual general meeting will be held in London on May 25th, and is to be followed by an ordinary meeting.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. D. R. WILSON has been unanimously nominated by the Council of the Illuminating Engineering Society as President. Mr. Wilson has done much valuable pioneering work on industrial lighting; the reports of H.M. Chief Inspector of Factories from 1911 onwards contained special contributions by him on the lighting of factories, and he took an active part in the subsequent formation of the Home Office Departmental Committee on Lighting in Factories and Workshops, of which he became secretary. He is also a member of the Illumination Research Committee, working under the Department for Scientific and Industrial Research, by which important researches bearing on industrial lighting have been carried out.

The Reading Borough Council has advanced the salary of Mr. ARTHUR HIGSON, who has charge of the electrical and mechanical gear in the Borough Engineer and Surveyor's Department, by £28 per annum to £340, plus £26 per annum car allowance.

The Spenborough Urban Council has made a special grant of £75 to the electrical engineer in respect of past and prospective special services in connection with the "change over" at the works.

Mr. R. H. WILKINSON, city tramway manager, Bradford, has been authorised by the Tramways Committee to take part in the visit to Budapest, as a member of the Committee of the Municipal Tramways Association, which is going there to inspect overhead equipment methods and other tramway matters.

The Accrington Town Council has considered a recommendation that the salary of Mr. CLEGG, the electrical engineer, should be increased from £866 to £913 per annum, with a further advance from April 1st, 1928, when the basic salary should be £750, plus the prevailing bonus. After discussion the proposal was referred back by 13 votes to 11.

The engagement is announced of Mr. S. DICKSON MOYSE, only son of Mr. and Mrs. Leon Moyse, of New York and Paris, and Miss KATHLEEN RAILING, younger daughter of Mr. and Mrs. M. J. Railing.

Mr. A. J. WARING, distribution engineer at the Torquay Electricity Works, who is leaving to become borough electrical engineer at Newark-on-Trent, has been presented by the staff with an eight-day clock.

On April 6th, the staff and employés of the Paisley Corporation Electricity Department met to honour seven of their number who have completed 25 years' service. Mr. W. Blair Smith, engineer and manager, presided, and Miss M. R. Hart made suitable presentations to the following employés:—Messrs. J. M. Barbour, G. A. F. Allison, R. Mitchell, Joseph Thompson, John Hogg, John Cunningham, and James Lawrie.

Confirmation has been received of the recent rumours that Mr. P. N. RAND, the general sales manager of the Metropolitan-Vickers Electrical Co., Ltd., is severing his connection with that company. He will officially terminate his connection with the M-V Co. on September 30th next (by which time he will have completed nearly 19 years with them), but will relinquish his active representation about the middle of May and indulge in a well-earned rest. He will be at Buxton during the I.M.E.A. Convention and in Newcastle for the I.E.E. Summer Meeting, after which he expects to travel abroad for a few weeks before taking up new duties. We join with Mr. Rand's many friends in wishing him success in his future activities. His address from the middle of May until further notice will be c/o Royal Automobile Club, Pall Mall, London.

Obituary.—MR. A. R. HARDIE.—We regret to learn from the *Financial Times* of the death, which occurred suddenly on April 8th, at the age of 74, of Mr. A. R. Hardie, who had been associated with submarine cable enterprise for 57 years. "Mr. Hardie came from Scotland, and as a very young man joined the old British Indian Submarine Telegraph Company under the late Sir John Pender in 1870. Two years later took place the great amalgamation of submarine telegraph companies, known to-day as the Eastern Associated Telegraph group—the largest cable undertaking in the world. He was appointed chief accountant of the Eastern Telegraph Company in 1886 at the early age of 33, becoming secretary in 1903 and a director in 1922." He leaves a son (Lieut.-Col. Claude Hardie, D.S.O., of the English Electric Co., Ltd.).

LT.-COL. P. W. D'ALTON.—We learn with feelings of deep regret of the death, which occurred on April 10th, at Westcliff, at the age of 71 years, of Lt.-Col. Patrick Walter d'Alton, M.Inst.C.E., M.I.Mech.E., M.I.E.E. We shall refer to the career of the deceased gentleman in our next issue.

Financial Section.

New Companies. Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Dionoid Battery Co., Ltd.—Private company. Registered April 6th. Capital, £10,000 in £1 shares. Objects:—To manufacture and repair electric accumulators of all types; to carry on the business of electricians, mechanical engineers and manufacturers, manufacturers of, and dealers in telephones and telegraphs (wireless or otherwise), dynamos, magnetos, &c. The subscribers (each with 100 shares) are:—G. H. Trotter, 17, Broomhall Road, Sheffield, engineer; H. H. Barton, 17, Broomhall Road, Sheffield, instructor captain, R.N. (retired). G. H. Trotter is the first director. Qualification, 100 shares.

S. L. Electrical Co., Ltd.—Private company. Registered April 6th. Capital, £200 in 1s. shares. Objects:—To carry on the business of electricians, manufacturers, generators, accumulators, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, &c. The directors are:—C. H. Morrell, 1, The Terrace, Champion Hill, S.E.5; E. J. Evershed (managing director), address not stated. Secretary: C. H. Morrell. Solicitors: Helliwell, Harby & Evershed, Thanet House, 231, Strand, W.C. Registered office: Thanet House, 231, Strand, W.C.2.

Cleartron (1927), Ltd.—Private company. Registered April 6th. Capital, £10,001 in £1 shares (7,501 "A" and 2,500 "B"). Objects:—To carry on the business of manufacturers of, and dealers in wireless apparatus and accessories of all kinds, &c. The subscribers (each with one "A" share) are:—Elsie E. Styles, 29, Rosetta Street, Stockwell, S.W., clerk; L. H. Gurney, The Den, Priory Avenue, Harlow, Essex, clerk. Directors: M. F. Mieville and others to be appointed by the subscribers. R. J. Ireland also signs as director. Registered office: 21, Cumberland Street, Birmingham.

Berkeley Electrical Engineering Co., Ltd.—Private company. Registered April 2nd. Capital, £15,000 in £1 shares. Objects:—To adopt an agreement with F. G. Minter, Ltd., and to carry on the business of electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of, and dealers in railway, tramway, electric, magnetic, galvanic, and other apparatus, &c. The first directors are:—F. G. Minter, 26, Norfolk Street, Park Lane, W.; F. A. Minter, "Greystock," Peek Crescent, Wimbledon Common; C. J. Goldsmith, "The Nook," Well Lane, East Sheen, S.W.14; A. E. Williams, "Callancrags," Woodcote Valley Road, Purley; A. H. Beatty, "Chellow Dene," Putney Hill, S.W.15 (directors of Balfour, Beatty & Co., Ltd., and other companies). Qualification, 100 shares. Solicitors: Walter Burgis & Co., 31, Budge Row, E.C.4. Registered office: 29, Buckingham Gate, S.W.1.

Dental and General Radiography, Ltd.—Private company. Registered April 7th. Capital, £100 in 99 "A" shares of £1 and 20 "B" shares of 1s. each. Objects:—To carry on the business of dental and general radiographers and radiologists, including also any curative, remedial, or therapeutic treatment by the employment of long or short wave-lengths, whether of light, heat or electricity, &c. The permanent directors are:—F. Daphne (chairman), 10, Charterhouse Square, E.C.1; L. F. E. Johnson, 9, Highbury Grange, N.5. Solicitors and registered office: Daphnes, 10, Charterhouse Square, E.C.

Loewe Radio Co., Ltd.—Private company. Registered April 1st. Capital, £100 in £1 shares. Objects:—To carry on the business of producers, manufacturers, importers and exporters of, or dealers in radio devices, instruments and apparatus of all kinds, &c. The subscribers (each with one share) are:—J. F. H. Kempler, 3 and 4, Clement's Inn, W.C.2, solicitor; G. M. Down (same address), articled clerk. Directors' qualification, 5 shares. Secretary (*pro tem.*): F. J. Wright. Solicitors: Brown, Turner & Co. Registered office: 3 and 4, Clement's Inn, Strand, W.C.2.

Ashworth & Smith (Electrical Supplies), Ltd.—Private company. Registered April 2nd. Capital, £1,500 in £1 shares. Objects:—To carry on the business of electrical, mechanical, civil, agricultural, or other engineers, &c. The first directors are:—R. Nette, 13, Hulme Hall Avenue, Cheadle Hulme, Cheshire; S. Gillett, 426, Buxton Road, Stockport. Qualification, 50 shares. Secretary: R. Nette. Solicitors: Pattinson and Harrison, Macclesfield. Registered office: 27, Blackfriars Street, Manchester.

Logan Electric Supplies, Ltd.—Private company. Registered in Edinburgh April 2nd. Capital, £1,000 in £1 shares. Objects:—To carry on the business of distributors of all kinds of electrical goods, &c. The subscribers (each with one share) are:—R. Logan, "Knocknair," Kilbirnie, retired school teacher; J. Logan, "Knocknair," Kilbirnie, wireless representative. Registered office: 144, West Regent Street, Glasgow.

Graver, Cousins & Co., Ltd.—Private company. Registered April 4th. Capital, £255 in £1 shares (250 5 per cent. cumulative preference and 5 ordinary). Objects:—To carry on the business of electrical, lighting, heating, ventilating, wireless, mechanical and general engineers and engineering contractors, &c. The subscribers (each with one share) are:—C. H. Cousins, 58, Mount Gold Road, Plymouth, general clerk; C. H. Pearn, 1, Spenser Terrace, Lipton Road, Plymouth, builder and contractor; H. F. Cousins, 58, Mount Gold Road, Plymouth, electrician; J. Graver, 27, Burleigh Park Road, Plymouth, electrician. Secretary: C. H. Cousins. Solicitor: C. L. Croft, 13, Princess Square, Plymouth.

Official Returns of Electrical Companies.

Nalder Bros. & Thompson, Ltd.—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. Return dated December 29th, 1926. 12,000 preference and 11,881 ordinary shares taken up. £13,881 paid. £10,000 considered as paid. Mortgages and charges, £5,738.

Vaca Falls Co., Ltd.—Capital, £50,000 in 15,000 preference and 35,000 ordinary shares of £1 each. Return dated December 31st, 1926. 5,000 preference and 35,000 ordinary shares taken up. £25,000 paid. £15,000 considered as paid. Mortgages and charges, nil.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated January 11th, 1927. 500 ordinary shares taken up. £500 considered as paid. Mortgages and charges, nil.

Sussex Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated December 8th, 1926. 18,049 shares taken up. £18,049 paid. Mortgages and charges, £10,000.

English Freeholds and Industrial Undertakings, Ltd. (formerly Water, Gas and Power Undertakings, Ltd.).—Capital, £4,000 in £1 shares. Return dated December 31st, 1926. 1s. per share called up. 700 shares taken up. £35 paid. Mortgages and charges, nil.

John Richards & Co. (Electrical Engineers), Ltd.—Capital, £6,000 in £1 shares. Return dated March 18th, 1927. 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges, nil.

London Electric Stores, Ltd.—Capital, £1,000 in £1 shares. Return dated March 2nd, 1926 (filed January 1st, 1927). 750 shares taken up. £750 considered as paid. Mortgages and charges, nil.

Power and Traction Finance Co., Ltd.—Capital, £250,000 in £1 shares. Return dated January 14th, 1927. 6,002 shares taken up. £6,002 paid. Mortgages and charges, nil.

Credenda Conduits Co., Ltd.—Capital, £50,000 in £1 shares. Return dated January 14th, 1927. All shares taken up. £30,000 paid. £20,000 considered as paid. Mortgages and charges, nil.

Simmonds & Stokes, Ltd.—Issue on March 29th, 1927, of £50 debentures, part of a series already registered.

Rangoon Electric Tramway and Supply Co., Ltd.—Satisfaction to the extent of £9,528 on December 29th, 1926, of debenture stock dated February 1st, 1906; December 22nd, 1908; November 5th, 1913; and January 25th, 1924, securing £250,000.

Electric Supply Co. of Victoria, Ltd.—Satisfaction in full on June 30th, 1925, of debenture stock trust deeds dated July 7th, 1905, and May 9th, 1907, securing £160,000 and £40,000 respectively.

Small Electric Motors, Ltd.—Satisfaction in full on March 15th, 1927, of mortgage dated October 29th, 1918, securing £2,500.

Hellyar & Sons, Ltd.—T. H. Hellyar, of 169, Church Road, Barnes, was appointed receiver and manager on March 11th, 1927, under powers contained in mortgage dated August 23rd, 1912.

English Electric Co., Ltd.—Satisfaction to the extent of £35,000 on February 24th, 1927, of first mortgage debentures, secured by trust deed dated September 15th, 1919, securing £1,000,000.

W. P. Love & Sons, Ltd.—Mortgage on certain freehold land, fixtures, &c., at Brenchley, Kent, dated March 24th, 1927, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

City Notes.

Babcock & Wilcox, Ltd.

The report for the past year records a net profit of £716,576; to this is added £188,774 brought forward, making £905,350. It is proposed to transfer £150,000 to the reserve fund (making £702,000) and £20,000 to the staff pension fund, and to pay a final dividend of 8 per cent., free of tax, on the ordinary shares (the interim dividend was 5 per cent.), leaving £161,442 to be carried forward. The death of Sir James Kemnal, the managing director, is recorded, and it is stated that during the year Sir Coles Child, Bt., and Mr. H. W. Kolle joined the board. Extensions were made to the factories and plant at Renfrew and Dumbarton, but the increased production which should have resulted was prevented by the general strike and coal stoppage. Considerable loss to the company and inconvenience to customers were caused by these disputes. The associated companies in this country and abroad were profitable in the aggregate. The Spanish company was fully employed, the French company paid a good dividend, and the German company has been well employed and has increased its dividend. The Italian company has not yet had time to develop fully and meet the unusually severe competition in Italy. The Japanese works have progressed and their extension is contemplated. The Australian works are now working under more favourable conditions; considerable progress has been made and large contracts are in hand. The Canadian company has suffered from the trade depression in Canada, but there are signs that the long overdue improvement is about to take place. Business in China is, of course, at a standstill. The advances in design have caused unusual demands on the staff during the year, but the company has demonstrated its ability to meet all its customers' requirements. The meeting is to be held on April 20th.

Metropolitan-Vickers Electrical Co., Ltd.

The 27th annual meeting was held on April 5th, Major-Gen. Sir Philip Nash presiding. In moving the adoption of the report, the chairman said that the profit for the year showed an increase of £3,153, which might be considered satisfactory in view of the industrial interruptions during the year. The actual output from the works during 1926 was slightly less than in 1925, which was a record year for the company, but bearing in mind the dislocation and interruption to industry which the coal dispute caused, the result was good. Moreover, relations between their workpeople and the management continued to be of the most cordial nature throughout the whole period. They experienced, however, during the prolonged coal stoppage considerable difficulty in obtaining certain classes of raw material essential to their business, and the general conditions which prevailed rendered the task of maintaining output abnormally difficult. Due to those industrial conditions in 1926 the home market for electrical plant, &c., was adversely affected, but towards the end of the year they were fortunate in obtaining a fairly large amount of business which brought the value of orders for the home market in 1926

nearly up to the total of the previous year. On the other hand, they had a considerable increase last year in orders obtained in the overseas markets, and measured in terms of tonnage the export orders obtained by the company last year were far in excess of any previous year in the company's history, though the prices obtained were barely remunerative. At the same time the obtaining of a large volume of work in the export market was essential to the well-being and progress of the company, and looking back over a term of years in which they had consistently carried out a policy of expanding their export business, he had no hesitation in saying that the results had fully justified the policy. Referring to the Central Electricity Board, he said that its work would be watched with close interest by all connected with the electrical industry, and he trusted that whatever might have been the opinions or criticisms of the Bill during its passage through Parliament, all sections of the industry would now combine to assist the Board to make the new Act a success. All were agreed that our country was behind other countries in the use of electricity, and the new Board, by an active and well-considered policy, had a great opportunity before it to undertake developments beneficial alike to the industry itself, and to the country as a whole. One of the important works which the Board would have to carry out was the installation of apparatus in connection with the high-pressure transmission lines contemplated in this country, a work which was outside the more standard lines of apparatus hitherto utilised in this country. The experience which their company had gained in the export field rendered it peculiarly adapted to undertake this class of work. Speaking of some of the larger contracts which were under process of being carried out by the company, he said that for the home market they were manufacturing large power house equipment for the Bristol and Liverpool Corporations. They were manufacturing to the order of the Manchester Corporation the largest turbo-generator set that had ever been installed in Great Britain. The new set was of a capacity of 40,000 kW, which would be installed at the Corporation's power station at Barton, which already contained three 25,000-kW sets of their manufacture. Their railway electrification business continued to expand, and in addition to a large order from the Southern Railway in this country, they were also manufacturing traction equipment for India, Brazil, Australia, South Africa, Spain, Czecho-Slovakia, Italy, Holland, and Argentina. They also had under manufacture at the present moment large pieces of heavy generating plant for New Zealand, Sydney Corporation, Shanghai, Rumania, and Russia, and other important contracts for h.p. apparatus of the most modern design for Argentina, Rhodesia, New South Wales, and other countries. He had referred earlier to the good relations which existed between the management and the workers. They had at their Trafford Park works a Works Committee, which had been operating for the last ten years, and the key-note of whose work was to create the right spirit in their workshops. That committee was composed of 15 delegates of the workmen drawn from the various departments of the works, and elected by the workmen themselves. In addition, four representatives of the management and one senior foreman served on the committee. The committee elected its own chairman each year, and it was interesting to record that for the last seven years the chairman of the committee had been one of their workers—Mr. Sam Ratcliffe—a man who was held in the highest respect by all ranks in the company, and was one of the trade unionists selected to visit America last year with the *Daily Mail* Mission. There was no question at all to his mind that the works committee was as necessary and as important a section of organisation as any in the company. They also had a staff committee and a women's committee. In another direction the company also endeavoured to make the conditions of its workers as attractive as possible, and with this object they had for many years had in operation a system of payment by results whereby the workers employed could earn without restriction substantial increases on their basic rates, depending on output. At the present time about 86 per cent. of the workers employed by them participated in those arrangements. Referring to the future, he said they commenced this year with a satisfactory volume of orders on their books, and, together with those which they might expect to obtain in the ordinary way during the year, their manufacturing facilities should be well occupied, provided there were no industrial or other interruptions. He did not see that the home market was, in the near future, likely to provide as much business as they had hoped it would do. It was clear to him that industry was recovering from the effects of the coal strike at a slower rate than was generally anticipated, and that at the termination of the strike, opinions generally were too optimistic. On the other hand, he saw no reason why conditions should not gradually improve so that later in the year this market might regain its former activity. In the meantime they would continue their activities in the export market which offered promise. Competition, however, in this market was as severe as ever, and it was there that the British manufacturer felt most the greatly increased costs arising from taxation. In addition to the increased burdens of national taxation the company was paying nearly three times as much in local taxation as it paid in 1914. He renewed the plea which industry made to the Government to enforce economy in national and local expenditure.—The report was adopted without discussion.

Automatic Telephone Manufacturing Co., Ltd.

Sir Alexander Roger presided at the annual meeting on April 7th, and in moving the adoption of the report and accounts (Elec. Rev., March 18th, p. 445), referred to the death of Sir J. S. Harmood Banner. He said that although the profit for the year appeared to be slightly lower, it was in fact higher owing to the disappearance of an item of debenture interest. Notwithstanding the difficulties of the past year, the company had achieved the largest output in its history, and although it was not yet working to the limit of its extended capacity, the prospects of the current year were encouraging. Referring to the company's contracts for the conversion of London telephones to automatic working, he said that it was hoped to introduce the service in the coming autumn. In addition to the progress made in London, the company had completed automatic exchanges at Shrewsbury, Gosport, Hayling Island, Ipswich, Cheltenham, Cosham and Marton, besides two manual exchanges at Weston-super-Mare and Upton. Considerable progress had also been made with the automatic equipment for Southport and Nottingham. In addition to those home contracts, several overseas orders had been completed, including those from Buenos Aires, Tokio, Sydney and Canberra (the Australian Federal capital). They had continued to receive valuable assistance from the Automatic Electric, Inc., Chicago, the pioneers of the Strowger system, which was now represented by over 3,000,000 stations. In the foreign market the company had demonstrated its ability to compete successfully in quality and price with the rest of the world. Dealing with the domestic apparatus branch of the business, the chairman said that the coal dispute had stimulated the demand for electric heating and cooking appliances and the company had secured a good share of the business. All steps were being taken to increase sales further by the improvement of the existing appliances as well as the production of new ones. The demand for their telegraph products maintained a steady level, but the mine-signalling branch naturally suffered. The company had developed a sub-station automatic control system; four examples of that system had been installed for Colonial railways, and several comparatively large schemes were under consideration. The building extensions had been completed, and those and the constant introduction of improved methods maintained production at a high level of efficiency. In conclusion, Sir Alexander referred to the work of the Telephone Development Association, the training of students at the works, and employés' welfare.

International Automatic Telephone Co., Ltd.

The annual meeting was held on April 8th. Sir Alexander Roger presided, and in the course of his speech dealt with the progress which had been made by the Automatic Telephone Manufacturing Co., Ltd. He said that it was seven years ago since the company undertook the exploitation of the foreign business of the manufacturing company and during that period a substantial business in many important centres abroad had been secured. The chairman then referred to the proposal to cancel the option which Messrs. Theodore Gary & Co. held on the issued preference capital of the company. (This was outlined in our issue of March 25th, p. 485.) He said that Messrs. A. F. Adams, Theodore Gary, and H. L. Gary (all American directors) had resigned from the board, being unable to give sufficient time to the company's business, although they promised the continuance of their support. Mr. H. L. Harris (a director of Theodore Gary & Co.) and Mr. G. W. Moore (manager of the Automatic Telephone Manufacturing Co., Ltd.), had been appointed to the board. Sir Alexander then dealt with the work of the Telephone Development Association and claimed for it a substantial part of the 8-11 per cent. increase in telephones during 1926. In conclusion, the chairman said that the A.T.M. Co. had invited the company's staff to participate in the benefits of the pensions fund, and arrangements were being made to give effect to that. The report and accounts were adopted, and at a subsequent extraordinary meeting resolutions were approved giving effect to the cancellation of the option upon the preference shares referred to above.

St. James' and Pall Mall Electric Light Co., Ltd.

The annual meeting was held on April 5th, Mr. G. W. Balfour (chairman) presiding. In presenting the report and accounts (Electrical Review, March 25th, p. 486), Mr. Balfour first referred to the death of the late chairman (Mr. Walter Leaf); to the resignation of Sir A. B. W. Kennedy from the position of chief engineer; to the appointment of Messrs. Andrews and Rowland as joint engineers; and the election of Mr. C. P. Sparks to the board. Turning to the accounts, he explained the altered form adopted, and said that the cost of energy had increased owing to the coal dispute, and the rates had also risen to a large extent. Special charges had to be met on account of the general strike, but absolutely no interruption had occurred in the supply. Owing to the reduction in the tariff, &c., the revenue had fallen by £11,000, although the sales had risen by 2.41 per cent. The growth of the demand was satisfactory. In the Regent Street and other areas additional converting plant and mains were being installed. Mr. Balfour then referred to the handing over of the Grove Road station to the London Power Co. The Central Co., he said, would continue as a separate entity; it had capitalised and distributed £225,000 of its free reserves in the form of £5 ordinary shares between the St. James'

and the Westminster Companies; in the case of the former the amount thus received was included in its free reserves and formed part of the £440,000 capitalised last year. They looked to the London Power Co. to effect economies in generation. A pension fund had been established for the employés, and to it the company had transferred £30,000 fully paid £1 ordinary shares. The report and accounts were adopted.

Metropolitan Electric Supply Co., Ltd.

Mr. G. Balfour, M.P. (deputy-chairman) presided at the annual meeting in the absence, through illness, of the Chairman, Mr. A. W. Tait. In presenting the report (*vide* Elec. Rev., April 1st, p. 528), Mr. Balfour referred to the altered method of producing the accounts, and said that they had a contract for nine years with the London Power Co. to take their requirements for the London area in bulk. With regard to the Western area, they were free to make their own arrangements. In the latter area they operated under a special Act enjoying perpetual tenure for the supply of electricity in bulk. They also owned the Uxbridge, Chesham and Brentford undertakings. The active policy of expansion adopted by the directors was indicated by the fact that during the past four years, £642,815 had been spent on mains and distributors. During the current year, £64,000 would be spent in the London area and £183,000 in the Western area for similar purposes. The output during the year was 84,800,000 kWh, of which 51,200,000 kWh was supplied to the Western area. The increase in business was larger than the increase in revenue indicated, for reductions amounting to £46,000 were made to consumers. Mr. Balfour quoted figures to show that during the past year no advantage had been gained by the company under the altered conditions. Other figures presented showed that the increase in gross receipts during the last five years had been a little over 2 per cent. in the London area and 200 per cent. in the Western area. After referring to the exchange of the 3½ per cent. mortgage debenture stock for Government loan stock, Mr. Balfour said that notice had been served on the holders of the 5 per cent. extension debentures that these would be redeemed on April 1st. The dividend paid for last year amounted to 12 per cent. on the original capital as against 11 per cent. for 1925. In seconding the motion for the adoption of the report, Mr. G. Verity said that the publicity given to the new Electricity Act had stimulated the sale of energy, and the company had experienced an increased demand from domestic consumers; the board was encouraging the growth of that business by the introduction of a two-part "all-in" tariff. The report and accounts were adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The annual meeting was held on March 29th, Mr. R. P. Sloan, C.B.E. (chairman) presiding. In presenting the report (*vide* Electrical Review, March 25th, p. 486), the chairman said that 1926 was the worst year that the North-East Coast had ever experienced. At the commencement of the coal stoppage the company had three months' supplies in stock; during the remainder of the period, in preference to buying foreign coal, they had purchased locally supplies of cheap coal, some of which had been lying about for 50 years. They had taken less than 50,000 tons from abroad. There was a serious reduction in output, but an immediate recovery when work was resumed at the mines. The stoppage involved the loss of the waste heat with which they generated much energy, and working costs were increased all round. Since 1914 local rates paid by the company had increased by 516 per cent., while the capital had only risen by 156 per cent. The amount paid was about sufficient to pay a dividend of 1½ per cent. on the ordinary shares. There seemed to be no prospect of relief from that burden. During the past year the new connections amounted to 30,762 h.p.; the proportion of that represented by domestic supplies far exceeded anything experienced before. They had only aimed at connecting up 12,000 new consumers, whereas the actual number connected was over 16,000. It had been thought prudent to reduce the amount transferred to reserve, and although the dividend was reduced from 7 to 5 per cent., it was paid on a larger capital and could not be considered unsatisfactory. Capital expenditure during the year totalled £413,655. A considerable portion of that had been spent on h.p. transmission and the 66,000-V system between the Tyne and Tees areas had been completed; £79,147 represented expenditure upon generating station plant. Dealing with the prospects of the current year, Mr. Sloan said that there had been a considerable revival, and they could look forward with some degree of confidence. At the beginning of the year they had orders for a further supply representing 25,331 h.p., and 2,840 new domestic consumers had been connected. It was hoped to occupy the new offices before the end of the year. The report and accounts were adopted.

City of London Electric Lighting Co., Ltd.

The annual meeting was held on April 6th. Mr. J. B. Braithwaite presided, and in moving the adoption of the report and accounts (Elec. Rev., April 1st, p. 527), said that the condition of electricity supply in this country had reached a definite and important stage. The effect of the London Electricity Acts, 1925, was to define the position of the London companies and get rid of the vagueness and uncertainty which prevailed. The companies were bound down to certain charges and dividends; in their own case they had decided to adopt the 1922 dividend as a standard, and that would remain in force until 1932. They were also entitled to retain—if they could earn it—a sixth of the difference between the standard price and the actual sums charged to consumers, and the employés were entitled to a similar amount under a co-partnership scheme. Already the power stations of the East End group of companies had been connected in accordance with the provisions of their Act. With regard to the Electricity (Supply) Act, 1926, Mr. Braithwaite said that that measure should result in a general impetus in the use of electricity; there was a boundless field open for the supply of electricity if it could be made reasonably economical to employ electrical appliances. Although the company's sales of energy had increased by about 4,000,000 kWh during 1926 the revenue was over £20,000 lower; that was due to the reductions made in the charges to consumers. The results of the first quarter indicated that the year was going to be a prosperous one. The company was capitalising £400,000 of the reserves and each ordinary shareholder would receive a bonus representing 50 per cent. of his holding. That, of course, would not make any difference to the actual amount of dividend received.

South London Electric Supply Corporation, Ltd.

This company's accounts were reviewed in our issue of April 1st. (p. 528). Sir Harry Renwick, K.B.E., presided at the annual meeting on April 5th, and explained the alterations effected by the London Electricity (No. 1) Act, 1925. He said that the standard price and dividend had not yet been settled, and £33,874 was carried forward. The capital expenditure during the year was heavy owing to the installation of new mains to take additional supply in bulk from the County of London Co., but the money had been well spent. In spite of the troubles of the past year the sales had increased by 750,000 kWh, and the number of new consumers had shown a satisfactory rise. Referring to the new Electricity (Supply) Act, Sir Harry said that at no time was the company hostile to it, but every assistance was rendered to make it a workable and useful measure. The Act as passed was a marked improvement upon the Bill as deposited, and should give a tremendous impetus to the demand for electricity supply. The Act had possibilities for conferring untold blessings on the industry, and the Central Board would have the wholehearted support of the company. Dealing with the reorganisation of the London electricity supply industry, the chairman said that the company was now taking practically the whole of its supply in bulk from the County of London Co., and it was hoped that that would have a good result in the accounts. A considerable sum had been written off in respect of machinery which would not now be required. The prospects for the current year were good, and the progress made so far was excellent. The shareholders now had a gilt-edged security—a thoroughly sound investment for the next forty years. The report and accounts were adopted.

Para Electric Railways and Lighting Co., Ltd.

Sir Francis M. Voules, C.B.E., presided at the annual meeting on April 5th, and in the course of his speech said that the revenue from both tramways and power had improved and that, combined with a higher exchange rate, had increased the sterling gross receipts by nearly 42 per cent. It was expected that the current year would compare favourably with that under review, although the majority of British public utility companies operating in Brazil would feel the effect of the low rate at which the milreis had been stabilised (5d.). There should, however, be a general improvement in trade which should bring greater income to the company. Just before the fall of the milreis to its present low value the new fares became operative; the uniform tariff was popular with their patrons and fair to themselves. The company had incurred expense upon the track and equipment, but it should earn a good return. He believed that the time was not far off when arrangements would be made to deal with the arrears of preference dividend; that had been retarded by the fall in the exchange.

Marconi's Wireless Telegraph Co., Ltd.

On April 7th an extraordinary meeting was held to confirm the resolutions for the reduction of the capital, &c., passed at the meeting on March 15th. Senatore Marconi presided and, in moving the confirmation, said that he had received a letter from Mr. Nordon's committee stating that it had been decided not to use the proxies at that meeting, but to make a protest when the proposals came before the Court. Mr. F. G. Kellaway seconded the motion, and Mr. Nordon then criticised the directors' proposals at some length. He contended that the resolutions before the meeting had not been passed effectively: a three-fourths majority had not been obtained. Dr. Sherlock (Dublin) supported the proposals on behalf of the Irish shareholders, and Major White also expressed his approval. Mrs. Farquhar Smith raised the question of the directors' remuneration and expenses, and Mr. Kellaway said that the figures quoted were greatly exaggerated. Eventually the confirmatory resolution was carried on a show of hands.

Bournemouth and Poole Electricity Supply Co., Ltd.

In moving the adoption of the report and accounts (Elec. Rev., April 1st, p. 528) at the annual meeting on April 7th, the chairman (Mr. J. A. Hosker) said that the output was

larger last year in spite of the coal dispute and general strike. The company had incurred extra expenses, but did not on that account increase its charges to consumers, although in March last year substantial reductions had been made. Dealing with the various items of expenditure, the chairman paid special attention to the amount of rent, rates and taxes paid, which, he said, was equivalent to 0.85d. per kWh. Rates, taxes and insurance absorbed £8,000 more than they paid for coal. Their efforts to reduce the costs by increasing the efficiency were largely negatived by the increase in those items. The business obtained so far this year was very satisfactory. In conclusion, he said that he had nothing further to report with regard to the acquisition of the undertaking by the local authorities.

London Electric Wire Co. & Smiths, Ltd.

The annual meeting was held on April 8th. Sir George H. Fisher-Smith (chairman), who presided, said that the company was in a very sound position. The troubles of the past year had reduced the output and lowered the profit by £12,437. The result was not unsatisfactory and was partly due to the provision of oil fuel in lieu of coal. The company's factories could have produced far more than they did in 1926, but the prevailing conditions restricted the amount of business available and the result was severe home and foreign competition. In conclusion, Sir George said that the Electricity (Supply) Act would not make itself felt for some time, but there was tremendous scope for development in this country.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Pinchin, Johnson & Co., Ltd.—17,500 ordinary shares of £1 each, fully paid, Nos. 522,501 to 540,000.

Shawinigan Water and Power Co.—72,816 shares of common stock of no par value.

The undermentioned have been ordered to be officially quoted:—

Ericsson Telephones.—99,980 (cumulative 7 per cent.) preference shares of £1 each, fully paid, Nos. 200,001 to 299,980.

Nigerian Power and Tin Fields, Ltd.

This company recently issued, for information only, a statement of its capitalisation and objects. It was formed on March 10th to generate and supply hydro-electric power to tin-mining companies and others operating on the Bauchi Plateau of Northern Nigeria. It is proposed to acquire a lease of the Kurra Falls (Gnar River) from the Nigerian Government for power purposes, as well as leases of other water and mining rights. The authorised capital is £500,000, of which the vendors, the Nigerian Base Metals Corporation, Ltd., are allotted £250,000, and will provide the working capital.

Richmond (Surrey) Electric Light and Power Co., Ltd.

Sir Harry Renwick, K.B.E., who presided at the annual meeting on April 7th, opened his speech with a reference to the death of Sir James Szlumper. Turning to the accounts (*vide* our issue of April 1st, p. 528), he said that, although expenses were greater on account of the coal dispute, the gross profit was slightly higher. There had been an increase in connections and output, although the directors' anticipations had not been fulfilled. They could look forward to better results in the current year, however, particularly if the present improvement in the country's trade continued.

German Companies.

The *Felten & Guilleaume Company*, Cologne-Mulheim, recommends a dividend of 6 per cent. for 1926, as in the previous year.

The *Transradio Company for Wireless Oversea Communication* reports that the extensions and improvements carried out in 1925 worked well during the past year. Considerable progress was made in the transmission of news to great distances by means of short waves, and a special building was established to deal with this service. The total of transmarine telegraphic traffic again experienced an increase. The accounts show net profits of 1,372,000 marks, as against 1,371,000 marks, and the dividend remains at 8 per cent.

The *Bergmann Electricity Works Company*, Berlin, reports net profits of 3,155,000 marks, as against 2,599,000 marks in 1925. It is proposed to increase the dividend from 6 per cent. to 8 per cent. The directors state that since the middle of last year business has improved and promises to extend further in the current year. It is proposed to raise the share capital from the 33,000,000 marks nominal to 44,000,000 marks.

The *United Aluminium Works Company*, Lauta, which is the controlling undertaking in this branch in Germany, and whose share capital is held entirely by the Reich, reports net profits of 4,250,000 marks, as compared with 3,930,000 marks in 1925. It is proposed to raise the dividend from 7½ per cent. to 8 per cent. Special appropriations are made to reserve as it is intended eventually to change over to the electro-thermic process for the production of alumina, so that it will then be necessary to write off the existing plant. The investigation of the bauxite mines in Hungary has revealed the existence of large deposits, and for this reason purchases from the Italian mines have been discontinued.

Belgian Company.

The *Société des Constructions Electriques de Belgique*, Brussels, reports a net profit of 1,775,621 fr. for the last financial year, as compared with only 109,140 fr. in 1925.

Cork Electric Tramways and Lighting Co., Ltd.

The revenue for the past year amounted to £138,900, and after providing for debenture interest, transferring £15,000 to depreciation and renewals reserve and £5,000 to general reserve, and adding £9,455 brought forward, there remains a balance of £29,994. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year (against 6 per cent.), and to carry forward £14,630. The expenses were increased by the coal dispute, but the increase was more than offset by the rise in revenue. Meeting: April 22nd.

La Plata Electric Tramways Co., Ltd.

From the profits of the past year £8,500 is transferred to reserve and £5,000 to renewals, while a dividend of 1½ per cent. is paid on the preference shares in respect of arrears, in addition to the year's dividend. £1,116 is carried forward.

Indo-European Telegraph Co., Ltd.

The directors recommend a final dividend of £1 2s. 6d. per share, free of tax, making 7 per cent., tax free, for the year. In addition, a bonus of 15s. per share, free of tax, is to be paid. This distribution is the same as for 1925.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The directors recommend dividends at the rate of 8 per cent. and 7 per cent. on the "A" and "B" ordinary shares respectively in respect of the past year.

Major & Co., Ltd.

The dividend for 1926 has been declared on the 6 per cent. preference shares, but the directors are unable to recommend any distribution upon the other classes of shares.

Wood & Cairns, Ltd.

The directors recommend a dividend of 7½ per cent. on both preference and ordinary shares for 1926.

Stocks and Shares.

Monday Evening.

Stock Exchange markets look forward to what may be expected to happen after Easter. For there is little enough business doing in the markets just now. Business is affected not only by the close approach of Easter, but by the still critical condition of affairs in China. The Budget is not so bad as might have been expected. The enormous deficit facing the Chancellor in connection with the year just ended has been known, of course, for the past fortnight, and its magnitude caused a good deal of uneasiness in the City. The manner in which the Chancellor has met the crisis came as a pleasant surprise to the many people who feared he would call for most of the loss to be met by heavy additions to income-tax.

The prices of investment stocks and shares maintain a firm front. Notwithstanding all the outpouring of new issues that has occurred during the past three months, there remains plenty of money available for investment. This seems anomalous, having regard to the fairly high Bank rate of 5 per cent. that has ruled over the past 16 months and the industrial conditions current during nine months of 1926. Practically every company report which appears nowadays contains references to the coal stoppage and the General Strike, blaming both for curtailment of profit or for working at an actual loss which the disputes entailed.

Nevertheless, prices keep up, for the reason that investment regards the events of last year as impossible of recurrence, and looks forward, as is its wont, to better times in the near future. It is on this impression that substantial rises have been reared during the last few business days in the prices of Home Railway stocks. The Undergrounds have failed to benefit to any marked extent, Districts and Metropolitans continuing at the same levels as before, while the Underground £1 shares have receded a trifle on selling by profit-takers who wanted to get their books clear before Easter. The steam stocks are strong, on expectations that the holiday traffics will show up very well against those of a year ago, and the further consideration that, for the next few months, every week will contribute to the extraordinary recovery which is likely to occur in the Home Railway industry as compared with the corresponding period last year.

The market for electricity supply shares is a good one, and the rises which have recently been achieved by Metropolitans, County of London and others are well maintained. There is a fair amount of supply obtainable in the list of ordinary shares, but amongst preferences the choice is more limited, owing to the ready manner in which shares are absorbed when they come to market. Brokers are frequently

asked to buy shares of which, when the market is tested, no supply is found obtainable, and it may prove of service to set out some of the amounts now on offer, or which were on offer at the time these paragraphs were written, giving the yield and other particulars. We draw these from a useful list issued by one of the principal firms in the electric lighting market of the Stock Exchange.

Stock. Offering.	Preference £1 shares.	Price.	Yield on last year's Dividend.	Dividends usually paid.
1,000	Adelaide Elec. 6½ p.c. "C" ...	21/9	£ 19 6	M. & S.
5,000	Atlas Light and Power 7 p.c.	20/9	6 15 0	J. & D.
500	British Elec. Transformer 7 p.c.	18/9 xd	7 9 3	M. & S.
1,000	Calcutta Elec. Supply 5 p.c. (Tax Free).	21/3	4 14 0 net	M. & S.
1,000	City of London 6 p.c.	22/9 xd	5 5 6	M. & S.
2,000	Clyde Valley 8 p.c. (2nd) ...	27/6	5 16 6	J. & D.
5,000	County of London 6 p.c. ...	22/9	5 5 6	J. & J.
500	Edison Swan 7½ p.c. (1st) ...	23 9	6 6 3	F. & A.
2,000	Electric Supply 6 p.c. ...	21/3	5 13 0	J. & J.
1,000	General Electric 6½ p.c. "A"	23/9	5 9 6	J. & D.
1,000	Llanelly & District 6 p.c. ...	17/-	7 1 3	F. & A.
2,500	Midland Counties Elec. 6 p.c.	21/9	5 10 3	M. & S.
1,000	Newcastle-upon-Tyne Elec. 7 p.c.	24/3 xd	5 15 6	M. & S.
2,500	St. Maurice Valley (Red) 7 p.c.	20/4½	6 17 6	J. & A. J. & O.
1,000	Scottish Power 8 p.c.	25/-	6 8 0	F. & A.
2,000	Sevenoaks & Dist. 8 p.c. ...	25/-	6 8 0	M. & N.
1,500	South Metropolitan 7 p.c. (1st)	25/9	5 8 9	F. & A.
5,000	Yorkshire Elec. Power 6 p.c.	23/-	5 4 3	F. & A.

Babcock & Wilcox are repeating the previously-paid 13 per cent. free of tax dividend on the ordinary shares, the net profit for 1926 of £716,600 contrasting with £785,000 in 1925 and £760,300 in 1924. The capital during the three years has remained unchanged at £4,576,712. The company's reserves now stand at £952,000, this including the dividend equalisation fund of £400,000. The extensions which were made to the plant, &c., did not fulfil the expectations formed of increased production owing to the General and Coal strikes. The figures in the balance-sheet are, however, very good, and the price of the shares has risen 1/16th to 53s. 9d.

Johnson & Phillips recovered to 47s. 6d., after having dipped to 46s. 3d. Amongst various shares marked ex dividend last week are British Aluminium, British Electric Transformer preference and Metropolitan-Vickers shares of both classes. The Telegraph Construction Company has declared a dividend making 10 per cent. for the year, the same as that for 12 months ago, and the Great Northern Telegraph dividend of 20 per cent. repeats the distribution paid for 1925.

The Marconi market is quiet, though a little disposition is noticeable to buy the shares of the subsidiary companies. Marconis themselves touched 18s. before reverting to 17s. 6d., at which the price appears to have settled down, and which it is thought may mark the probable level of the shares between now and the time when anticipation will start discussing the expected dividend. In the cable group, the changes are mostly upwards. Westerns have risen to 17, and Eastern ordinary, ex dividend, is 172½, recovering part of the deduction made last Thursday, the Stock Exchange pay-day. Automatic Telephones are weak, the price giving way to 48s. 9d., and this in its turn influenced Internationals, which are a somewhat dull market at 2 1/16. The deferred stand about 1s. less. Telephone Manufacturing have hardened a trifle to 7s. 3d.

The list of home and foreign tramway stocks is quiet and somewhat uninteresting. Brazilian Tractions fell a point; Barcelona Tractions, on the other hand, keep good at 48. Anglo-Argentine Tramways preference shares are steady, in spite of a rumour to the effect that the expected settlement between the company and the Buenos Aires municipality is by no means reached even yet. The report of the La Plata Tramways shows the company to have turned the corner after a good many years of unprofitable working. The dividend of 6 per cent. on the preference shares is to be met, plus 1½ per cent. on account of arrears, which at the moment stand at 71 per cent. The price of the preference is 20s. 6d. cum eighteenpence dividend, and a little speculation has developed in the ordinary, which stand at 4s. 1½d.

Some little talk has arisen, as mentioned here before, of low-priced tramway shares offering scope for speculative possibilities. Nobody would think of buying the shares as a serious investment, but, taking the ground that the L.C.C. has far too much money locked up in tramways for the Council to abandon the latter altogether, it is contended that the day must come when, agreement having been reached on traffic control, the London tramways will be taken seriously in hand and set upon a paying basis. This is the reason that inspires a little inquiry for such shares as London United Tramways ordinary and preference, London and Suburban Traction ordinary and preference, and one or two others. There is not much market in these shares, and anybody who buys them does so in the full expectation of having to put them away for some considerable time, the aim being not so much a present profit of a shilling or so per share, but of doubling the money in days to come. For people who like this kind of speculation, it must be admitted that the low-priced tramway shares hold a certain amount of attraction, but clearly they are not for the widow or for the orphan.

Pennsylvania Water and Power shares are 5 dollars higher at 194¼: Mexican Light and Power first mortgage bonds shed 3. The Rubber share market is quiet and featureless. Iron and steel descriptions show a harder disposition, on the hope of more favourable trade in the ensuing months of this year.

Share List of Electrical Companies.

	Nom. £	Dividend. 1925.	Dividend. 1926.	Price Apr. 11 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14	14	60/9	—	4 12 0
Brompton Ordinary	1	10	8⅝	25/6	+6d.	7 5 3
Charing Cross Ordinary	1	15	8½	25/-xd	—	5 13 0
do. do. 4½ Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8⅝	25/-	—	5 12 0
City of London	1	15	10	28xr	—	5 1 10
do. do. 6% Pref. ...	1	6	6	22/6xd	—	5 6 8
Clyde Valley	1	8	8	31/-xd	—9d.	5 3 3
County of London	1	15	7½	27/6xd	—	5 1 10
do. do. 6% Pref. ...	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation ...	1	10	10	31/3	+9d.	6 8 0
Kensington Ordinary	1	15	8	25/-xd	—6d.	5 12 0
Lancs. Light and Power ...	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	8½	24/-xd	+6d.	5 16 8
do. do. 6% Pref. ...	5	6	6	5 7/16 xd	+1/16	5 10 4
Metropolitan	1	11	8	28/-xd	+3d.	5 0 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary ...	1	7	5	22 6xd	+9d.	4 9 0
do. 5% Pref. ...	1	5	5	17/6xd	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-xd	+6d.	5 16 8
Notting Hill 6% Pref.	10	6	—	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6xd	—	5 9 10
South London	1	15	8½	25/-xd	+6d.	5 12 0
South Metropolitan Pref.	1	7	7	1¾	—	6 3 0
Urban Ordinary	1	4	7	25/6	—	5 9 10
do. 6% Pref.	1	6	6	1 1/16	+9d.	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 13 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	22/6	—	5 8 4
Home Rails.						
Central London Ord. Assented ...	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	3	62½	—	4 16 0
do. District	,,	3½	3½	59	—	5 18 8
Underground Electric	£1	Nil	1½	16/-	—6d.	1 17 6
do. do. Income ...	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	23¾	—	6 6 0
Automatic Telephone	1	3	10	48/9	—1/3	4 2 4
Chili Telephone	5	5	6	6¾	+⅛	4 11 6
Cuba Sub. Ord.	10	5	5	7	—	7 2 10
Eastern Extension	10	10	10	17⅞xd	—	*5 14 10
Eastern Tel. Ord.	Stock	10	10	173½xd	+1	*5 15 10
Globe Tel. and T. Ord.	10	10	10	18½	+¼	*5 8 1
do. do. Pref.	10	6	6	10⅞	+⅛	5 10
Great Northern Tel.	10	20	20	27	—	7 8 2
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	17/6	—	... ...
Marconi-Marine	1	10	7½	23/9	—	6 6 4
Oriental Telephone Ord.	1	12	12	52/-	—	*4 12 4
United R. Plate Tel.	5	8	8	8⅞	+1/16	*4 11 5
Western Telegraph	10	10	10	17	+⅛	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅞	+	8 2 6
do. do. 2nd Pref. ...	5	6	6	3 1/16	—	9 1 2
do. do. 5% Deb. ...	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord. ...	,,	8	—	142½	+1	5 13 8
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	5	6	136	—1	4 8 3
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	89½	—	5 11 9
do. do. Preferred ...	,,	6½	6½	115½	—1	*5 8 3
do. do. Deferred ...	,,	8	—	156	—	*5 2 9
do. do. Deb.	,,	4½	4½	79½	—	5 7 0
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	7/9	+6d.	Nil
London United Tram. Deb. ...	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	21	—½	6 18 0
Mexican Light Common	100	Nil	Nil	45	—1	Nil
do. Pref.	100	Nil	Nil	99½	—	Nil
do. 1st Bonds	—	5	5	68½	—3	7 6 0
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	53/9	+1/3	*4 16 9
British Aluminium Ord.	1	12½	10	43/9xd	—3d.	4 9 5
British Elec. Transformer Pref. ...	1	Nil	7	18/ xd	—9d.	7 9 0
British Insulated Ord.	1	15	—	70/-	—	4 5 9
Brush Ord.	1	10	—	28/3xd	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	—	30/-	—	6 13 4
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref. ...	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	90/-	—	4 8 11
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	18/9	—	*5 6 8
Johnson & Phillips	1	17½	—	2½	—1/16	7 7 4
Met.-Vickers Ord.	1	8	8	27/6xd	—	5 11 4
do. Pref.	2	8	8	2 3/16xd	—1/16	6 14 9
Siemens Ord.	1	7½	—	26/9	—	5 13 2
Telegraph Construction	12	10	10	29	—	*4 2 9

* Dividends paid free of Income Tax.

French Industrial Progress.

The Export Position Strengthened.

THE Department of Overseas Trade has recently published a report (through the Stationery Office, 7s. 6d. net) upon the economic and industrial conditions in France, 1925-26, by Mr. J. R. Cahill, Commercial Counsellor at the British Embassy, Paris.

The introduction to this report deals with the recovery of France from the effects of the war, with particular reference to the reconstruction of the devastated provinces. This reconstruction has been assisted by the employment of efficient up-to-date machinery; in the mining industry, especially, the equipment has permanently enhanced efficiency. The shortage of agricultural labour has been met by the "importation" of foreigners and by State aid for the installation of electricity in rural districts—a movement which is making immense progress. State aid has also been accorded to the great electrification schemes of the Paris-Orleans and Southern Railways. The supply of electricity is being universalised by the co-operation of private persons and public authorities, and the eventual realisation of the great Rhône and Rhine canal and water-power schemes and other projects held in abeyance through lack of funds will further endow permanently the national economic equipment. The introduction includes a table showing the advance made since 1913 in the direction of plant and equipment. The increase in generating capacity is indicated. Hydro-electric installations have risen from 647,000 kW in 1913 to 1,900,000 kW in 1926; and "thermic" stations from 1,000,000 kW to 3,500,000 kW. The electrified mileage of the railways rose from 153 in 1913 to 820 (estimated) in 1926.

A large portion of the report is devoted to the financial situation and the efforts of the Government to stabilise and restore the currency are dealt with. Other matters which receive attention are the proposed tariff revision (a translation of which was recently published by the Board of Trade), trade fairs, commercial treaties, &c.

The Electrical Industries.

Mr. Cahill says that the French engineering industries, which are stated to employ a total of 800,000 workers, have, with few minor exceptions, enjoyed full prosperity during the last eight years, broken only for a time in 1920-21. The automobile and electrical industries together probably employ half of the total number of workers and have had a brilliant course. The transformation brought about during the war has placed France in the front rank of industrial countries, an evolution which is testified to by the expansion of engineering exports. As regards the electrical branches, while the railway electrification and hydro-electric programmes were not proceeded with so rapidly as had been anticipated, owing to financial stringency, steady progress was made. The general advance in the utilisation of electricity in factory, farm, office and home, however, provided ample compensation. Out of a total of 38,000 communes in France, the number supplied with electricity has grown from 2,000 in 1911 to 6,820 in 1918, 8,200 in 1922, and 16,000 in 1926. The consumption per head of population has been increasing at the rate of 15 per cent. per year. In Paris itself the consumption (140 kWh per head) represents an increase of 370 per cent., as compared with 1913. The consumption in Lyons is 516 kWh, in Marseilles 216 kWh, in Strasbourg 230 kWh, and in Annecy 630 kWh. The advance of radio has also afforded much additional employment to the industry, and the development of the telephone services has had a similar effect. In foreign trade France has made astonishing progress. According to the French Federation of Electrical Associations, the share of France in the international trade in electrical material rose from 6 per cent. in 1913 to 11 per cent. in 1924. That of Germany had diminished, that of Switzerland had slightly increased, and the share of the United States had increased by 50 per cent. In actual figures, French exports rose from 10,400 tons in 1913 to 16,700 in 1923, and 23,600 in 1924. There was a fall to 20,200 tons in 1925, and the total for the first nine months of 1926 was 15,460 tons. The fall is said to be due to the shortage of labour and the keen home demand.

The capital invested in the electrical industries is computed at 8 milliards of francs. The leading position is held by the supply industry with an investment of 5 milliards. In the manufacture of electrical material the capital employed is stated to be 2.2 milliards. The heavy material branch shows a capital of 400 millions, and an annual output valued at 350 millions. The light material branch raised the value of its output from 45 millions in 1913 to 250 millions in 1925, and its exports increased five-fold during the same period. The value of the output of accumulators and dry batteries is five-fold (100 million fr.) for that of 1913, and of exports four-fold. The output of porcelain insulating material rose from 5,000 tons in 1913 to 20,000 tons in 1925. The comparatively new radio industry has an investment of 250 million francs.

A table showing France's foreign electrical trade indicates that the imports rose from 7,600 tons in 1913 to 7,800 tons in 1925; and the excess of exports over imports from 2,600 to 12,400 tons.

Electricity Production and Distribution.

At the beginning of 1925 the total installed capacity was put at 5,042,108 kW (3,228,848 kW "thermic" and 1,813,260 kW hydro-electric). Of the latter there were officially stated to be 213 stations with a power of 1,000 kW or over, representing a total of 1,263,260 kW, and 42,000 stations of less than 1,000 kW making up the balance. The normal capacity of the large stations was given as 683,750 kW. As expressed in h.p., an official return assigns, out of a total of 2.4 million h.p., 1.35 million to general distribution, 0.85 million to electrochemical and electrometallurgical industries, 0.1 to traction, and 0.1 to miscellaneous uses. The increase of one million h.p. since 1914 is almost entirely due to the creation of large stations. France now ranks second to Italy in the list of European hydro-electric countries, but development in Italy is proceeding more rapidly. Among the thermic stations there are at least 11 with a capacity of over 50,000 kW, of which five are in the Paris area (including Gennevilliers—340,000 kW). The principal developments in this direction have taken place in the north of France. In 1926 France possessed 7,000 miles of e.h.p. and h.p. lines. The State has spent nearly 200 million fr. on the distribution of electricity in the devastated areas.

Reverting to hydro-electric power, it is estimated that the potential water power in France amounts to 10 million h.p., of which 5 million h.p. is in the Alps, 2 million in the Pyrenees, and 2 million in the Central Plateau, Eastern France, and the Jura. Schemes are in hand for the development of 330,000 kW, of which 90,000 kW can be in operation by January 1st, 1928. Owing to the tightening of money and the more plentiful supply of coal construction has slackened and little progress has been made with certain of the larger schemes. In 1925 State assistance to the extent of 10,800,000 fr. was given to water-power projects.

Railway Electrification.

The report says that slow but steady progress has been made in the electrification programmes of the two railways which have definitely adopted the policy of electrification on a large scale, namely, the Paris-Orleans and the Midi (Southern) Railways. The Paris-Lyons-Mediterranean Railway appears to be confining its construction to the Culoz-Modane line (84 miles). Electric trains are now operating on several sections of the Paris-Orleans line and the company's auxiliary, the Union Hydro-Electrique, has opened its 80,000-kW station at Eguzon. The Midi Company has completed two long stretches, Toulouse-Dax and Bordeaux to the Spanish frontier and several branch lines. Three power stations in the Western Pyrenees and three in the Eastern Pyrenees, out of five and seven, respectively, are now in operation. The programme of the three railway systems mentioned provided for the electrification of about 2,000 miles in each case. At the date of the report the following proportions had been executed:—Midi, one-third; Paris-Orleans, one-eighth; and Paris-Lyons-Mediterranean, one-twentieth. In addition to these many smaller lines have undertaken electrification.

Telephones and Radio.

The latest figures available show that the number of telephone subscribers in France had risen from 310,000 in 1913 to 635,000 at the end of 1924. Many improvements and extensions have recently been effected. In April, 1926, an underground cable between Paris and Strasbourg (494 km.) was opened; this was to be followed by cables connecting Paris with Rouen, Havre, Lille, Lyons, and Marseilles.

A great deal of work has been done in the direction of linking up France with her colonies by means of radio-telegraphy, and a number of important stations are now working, while others are in hand. With regard to broadcasting, the report states that the number of persons with receiving sets is large and increasing.

General.

Among other matters, the report refers to the rapid development of the French aluminium industry, and says that the home demand is still greater than the output. Rapid progress has also been made by the electrochemical and electrometallurgical industries which at the beginning of 1926 had an estimated capital of 1,155 million fr. Reference is also made to the proposed revision of the tariff; pending this the Government made two increases of 30 per cent. in specific duties during 1926, while *ad valorem* duties were left unaltered. (Since the report was issued the Board of Trade has published a translation of the proposed new tariff.)

A Railway Signalling School.

The newly-established school of the London Underground Railways at South Kensington, which is equipped with all types of electric signalling apparatus at present in service.

A SCHOOL for the training of signal linemen, fitters, and installers of the London Underground Railways has recently been established at South Kensington, Piccadilly Line, where classes are held and opportunities afforded for voluntary technical and practical training. The school, which is accommodated in a tunnel adjacent to the station, is laid out part as a laboratory and part as a lecture room, the latter having a capacity for about 60 students. The laboratory is equipped with every class of signalling apparatus actually employed on the railways so as to represent as nearly as possible actual working conditions.

A miniature track has been arranged over a bench running the whole length of the room, fig. 1. To this track is connected track-circuiting apparatus standing on the bench below, so that the whole is completely exposed for inspection and demonstration. On the left of the gangway running in front of the bench are arranged signals and train stops controlled from the miniature track, the whole representing a length of line equipped for automatic signalling. Five different types of track circuit are installed to work in conjunction with the miniature lay-out, and the whole shows clearly the operation of the signals corresponding to the positions of the trains on the line. The track circuits include the following types: diagram, condenser-feed, resistance-feed and impedance-bond, all for a.c. operation and working in conjunction with various types of signals.

One end of the room is fitted up to represent a signal cabin complete with a 7-lever power frame and illuminated diagram, fig. 2. The frame controls five signals and one pair of points;

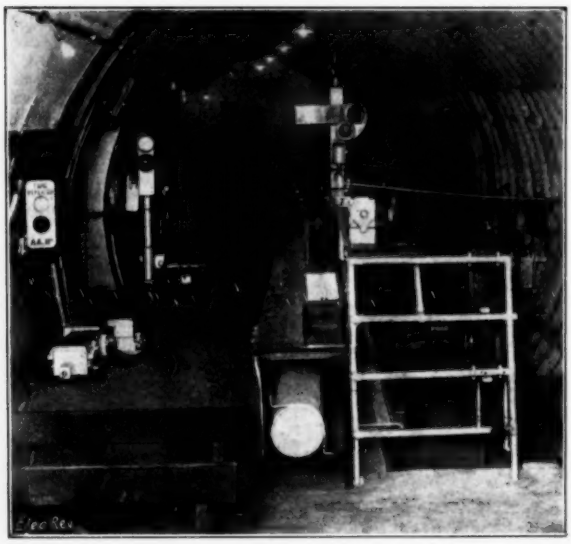


Fig. 1.—Signal School, showing Miniature Track.

a king lever is fitted, which, when reversed, allows certain of the signals to work automatically. The various relays working in conjunction with the signals controlled from the power frame are exposed for inspection, and the whole of the apparatus is wired up and operates exactly as in actual service.

A length of full-size permanent-way, fig. 3, runs along the school on the lower level, and in conjunction with this signals and apparatus are fitted in the same manner as on the railways. The permanent-way is complete with a pair of points, to which a full-size point lay-out of the L.E.R. electro-pneumatic type is fitted. The layout is equipped with an escapement and a lock and detector box, and does not allow the signals reading over the points to be cleared if the switches are not closed to within ¼ in. of the stockrail in the right direction. This means that should the points become jammed through any foreign matter getting into the switches, the lever in the cabin would be held half-way over, the signal remaining at danger. This is carried out by means of a relay situated in the signal cabin and worked through the detector box on the points. An additional safeguard fitted to this layout is a special track lock which fixes the bolt of the points in the locked position so long as there is a train running over the track circuit in the vicinity of the points, thus preventing the possibility of the points being thrown whilst a train is

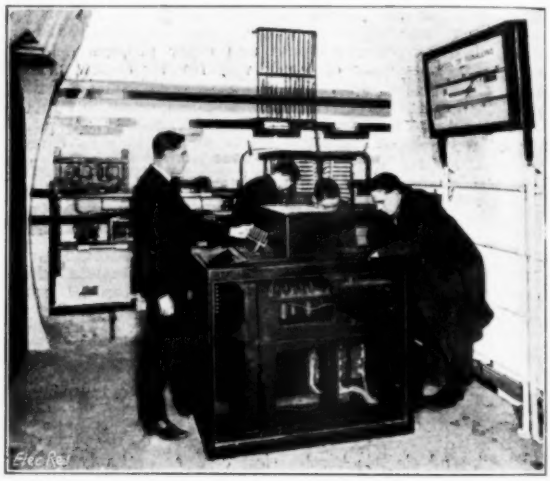


Fig. 2.—Signal Cabin.

passing over them. An a.c. electric point machine and controller is connected up so that it can be operated from a tumbler switch and the functioning of the machine watched.

Every type of track-circuit and other signalling apparatus employed on the railways is represented on the permanent-way.

An interesting feature of the equipment is an experimental track circuit for showing the effect of wet or dry weather on a track circuit. The apparatus is arranged in a tank and

Fig. 3.—Permanent Way.

a number of wire tails hanging from a pair of "rails" vary the leakage resistance of the circuit according to the depth of water, representing various weather conditions.

Examinations are held at the end of each session, so as to gauge the progress of the students. The school is also used for the examination of each individual lineman before he is placed in charge of a section on the railways.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Electric Safety Kettle.

A recent production of MESSRS. SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, London, E.C.4, is the "Xcel" safety kettle. This is fitted with an automatic cut-out which breaks the circuit at a temperature a little above boiling point. The cut-out embodies a bridge contact which is normally held across two spring terminals by means of a fusible nut engaged with a screw in the kettle bottom. When the kettle runs dry the nut fuses and releases the bridge, which

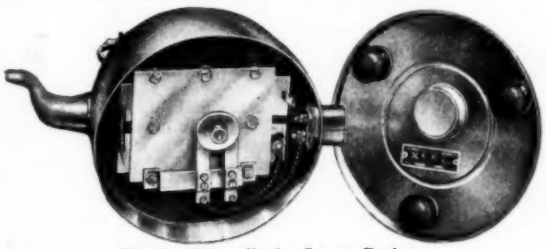


Fig. 1.—Safety Kettle, Cut-out Device.

is dropped into a small well pressed into the bottom cover. The break is assisted by a spring. A new collar can be screwed on without the aid of any tools, when the kettle is ready for service again. Each kettle is supplied with one spare fuse, and the cost of new fuses is negligible. Fig. 1 shows the automatic arrangement in the bottom of the kettle, the cover being removed. The appliance is made in capacities of 2¼ and 3¼ pints, with respective loadings of 650 and 800 W, and is made up in polished copper, nickel-plate or silver-plate.

An Electric Lawn Mower.

We illustrate in fig. 2 an electric lawn mower, the "Electra," which has been recently put on sale by MESSRS. RANSOMES, SIMS & JEFFERIES, LTD., Orwell Works, Ipswich. This is an entirely new model, and is fitted with a totally enclosed electric motor. The special features claimed for it are the independent drives to the cutting cylinder and land rollers, and the simplicity and ease with which it is operated. The cable is manipulated and controlled by a patented cable arm. The cable connection is similar to that for an ordinary electric fire or vacuum cleaner, and the motor is started by

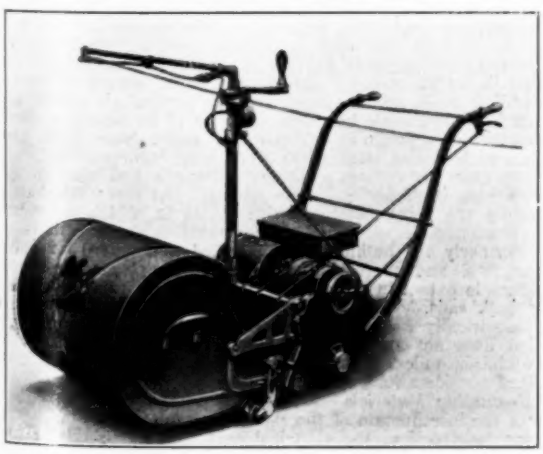


Fig. 2.—Electric Lawn Mower.

means of a simple switch. The machine is constructed with mild-steel side-frames, ensuring, it is claimed, rigidness and efficiency in work on all classes of lawns. The high-speed cutting cylinder and the vibrationless electric drive should make this machine an ideal power mower for bowling greens.

A New Electric-Bell System.

In order to provide a means of using the ordinary signalling bell in conjunction with the electric lighting installation, without the introduction of expensive transformer apparatus, Mr. W. K. LEWIS, 54, Muswell Road, Muswell Hill, London, N.10, and Mr. A. J. ANIDO, 60, Chancery Lane, London, W.C.2, have brought out a new system which is intended to be installed at the same time as, and in conjunction with, the electric lighting system. Fig. 3 shows the arrangement for a simple system for a single bell (*g*) wired up with an indicator (*f*). One wire (*e*) only is employed for the bell which connects this, through the indicator, to a special 2-way switch or push (*c*) wired up in series with the ordinary lighting switch (*b*) on one way. The bell terminals

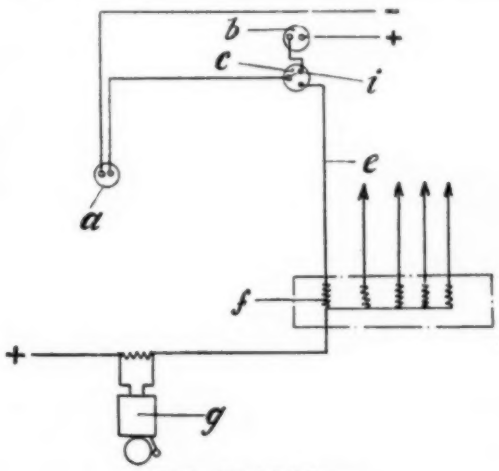


Fig. 3.—Novel Bell System.

are shunted so as to give a small volt-drop across the operating coil. With the 2-way switch in the lower position the bell shunt is put in series with the lamp (*a*) which indicates whether the bell receives the necessary operating current or not. The system is suitable for ordinary electric lighting pressures for which the wire and push are, of course, suitable. The indicator coil consists of only a few turns of low-resistance wire. It will be realised that the additional cost of the system over that for an ordinary bell circuit with batteries, the bell wire being drawn in with the lighting wires in the first place, is negligible.

An Improved Switch.

In our issue of September 17th, 1926, p. 479, we described a circuit breaker which had recently been introduced by MESSRS. J. G. STATTER & CO., Queen Anne's Chambers, Westminster, S.W.1. A modified design of this apparatus, which

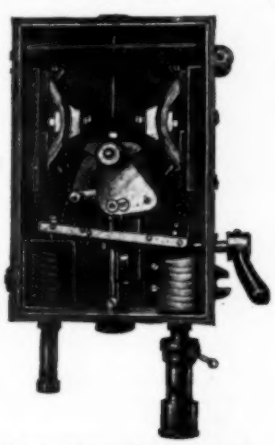


Fig. 4.—Improved Circuit Breaker.

still embodies the scissors movement of the laminated contact brushes, has now been produced, fig. 4. The main alteration is the provision of a side operating handle in place of a pull-down knob, enabling, it is claimed, the breaker to be more easily operated.

Electricity in Warships.

A survey of the applications of electricity on board British naval vessels.

By W. McCLELLAND, C.B., O.B.E., M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 576).

Heating, Cooking and Baking.—Many types of electrical heating apparatus are being fitted in warships in increasing numbers, and in submarines general use is made of electrical methods as they are the only ones permissible when submerged. A standard radiator is used and electric fires of the imitation coal-fire type also are fitted in principal cabins and ward rooms. Two main types of elements have been standardised: the first consists of wire or tape wound on a mica former, and is intended for hot-plates, urns and kettles; the second consists of a coil of wire supported in a fireclay former and is a low-temperature element for use in ovens and hot-cupboards. Manufacturers, however, are permitted to supply approved low-temperature elements of their own design in lieu of the second type mentioned, but such elements must conform to specified dimensions and fixing centres. For radiators, a luminous type of element is generally required.

Two sizes of electric hot-cupboards have been designed for use in all types of ships. They are constructed of aluminium alloy, and are provided with lagging 2 in. thick, and the elements are mounted on the inside wall of the cupboard, being merely protected from damage by a perforated shield; elements can be readily renewed, the dimensions representing the clear space inside the cupboard :—

Size 1.—20 in. wide, 16 in. deep, 27 in. high—1,000 watts.
Size 2.—32 in. wide, 20 in. deep, 27 in. high—2,000 watts.

Electric bread-baking ovens of full-sack capacity are being fitted in the latest ships. Tried against a steam-heated oven, the electric oven showed marked superiority in the time required to attain baking temperature, both from the cold

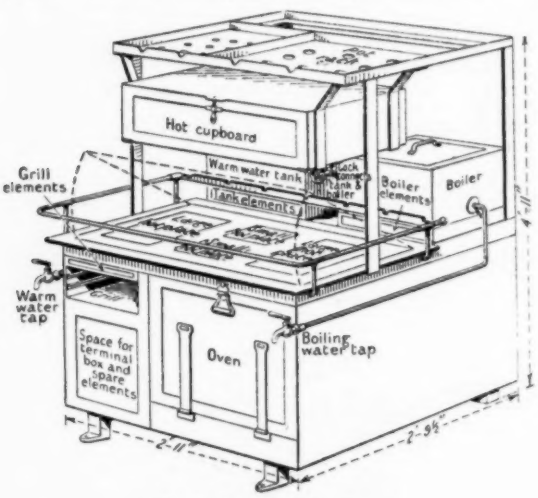


Fig. 5.—Electric Galley Range.

condition and after the removal of a batch of bread; in the tropics such quick service is a great boon. Fig. 5 shows an electric galley for a surface ship, designed to meet the requirements of 15 to 20 officers. One of its special features is the arrangement for a supply of water at both 212 deg. F. and about 160 deg. F. The warm water tank is enclosed, and fills automatically; the boiler is fed from the warm water tank.

Cables.—The total length of single conductor in a large warship is of the order of 300 miles, and the importance of obtaining cables which will satisfactorily withstand the severe conditions of naval service needs no emphasis. Single-conductor cables are used throughout for the electric light and power circuits, but multi-core cables are extensively used for the low-power installation and for the control of circuit breakers. A very wide range of patterns is covered by the standard sizes; rubber-insulated, lead-sheathed cables were adopted as the standard in the British Navy almost from the beginning of naval electrical work, and still form the bulk of those used in H.M. ships. Wire armouring is sometimes used over the lead where additional mechanical protection is required, *e.g.*, the multi-core cables for circuit-breaker control wiring. The important ring main and certain other cables which are paper-insulated and lead-sheathed are also steel-wire-armoured. In submarines tough-rubber-sheathed cables are largely employed on account of weight and flexibility in comparison with the stiffer lead sheathed cables.

Considering rubber-insulated cables as a class, their most serious fault for warship work is the inability of the insulation satisfactorily to withstand the high temperature to which it may be subjected in service; it may reach 170 deg. F. on the lead with an environment of 150 deg. F., and with varying humidity of atmosphere the layer of pure rubber, which it has been the practice to use next to the conductor, becomes plastic, whilst the compound rubber in many instances becomes either plastic or hard and brittle, depending on the materials used and the conditions of manufacture. It is doubtful whether the pure rubber next to the conductor is of any real value for cables liable to be operated under the conditions mentioned, and it might be preferable to protect it by other means. It is specified that no dripping shall occur when a sample of the cable is suspended vertically for 24 hours at a temperature of 75 deg. F.; the viscosity of the impregnating compound is very important in warship work. With the ordinary commercial types of compound chamber for sealing the ends of cables feeding switches the impregnating compound tends to leak into the switch, especially if the box is situated below the level of the ring main. Instances are also on record, owing to loss of impregnating compound, of short-circuits between cores occurring in multi-core, paper-insulated cables run vertically; the paper at the top of the run became dry and brittle and vibration caused it to flake away sufficiently to allow neighbouring cores to make contact. To overcome difficulties of this character it is necessary to design sealing arrangements capable of remaining oiltight under a resin oil pressure of 50 lb. per sq. in. for 2 hours at a temperature of 200 deg. F. The introduction of paper-insulated cables for warship work, and the precautions taken in connection with them, have been fully justified by experience.

In addition to the fixed cables, a large amount of flexible cable is used in warships: it is rubber-insulated, but the mechanical protection depends on the service for which it is to be used and may be cotton braiding, cord braiding, phosphor-bronze braiding, tough-rubber sheathing, &c. For certain purposes, *e.g.*, gun-firing circuits, owing to run-out recoil of guns, &c., the conditions are particularly severe, and considerable trouble has been experienced by breakage of the conductors. Tough-rubber-sheathed cables have been used in which tinned steel wires have been incorporated in the conductors to secure additional strength and also in the sheathing itself for the same purpose, but more satisfactory results are being obtained with cables in which a canvas reinforcement is embedded in the tough-rubber sheathing.

Formerly the bulkheads were drilled and tapped for fixing purposes, and perforated plating was employed to a considerable extent in order to reduce to a minimum the drilling of bulkheads. With the development of satisfactory methods of electrically welding studs to steel plates* the drilling objection does not apply, and cables are now secured direct to bulkheads unless obstructions, temperature of bulkhead, or other considerations render plating necessary.

Insulating Materials.—About 1904, an important departure was the introduction of the skeleton frame method of switchgear construction, the electrical gear being clamped to steel bars insulated by tight wrappings of micanite; it has been satisfactory in service, and has been standard practice in the British Navy for over 20 years. The main objection to micanite is the liability of the varnish binder to soften at comparatively low temperatures. The introduction of the phenol-formaldehyde varnishes, generally known as bakelite varnish, gave rise to the hope that this defect would be overcome, since this type of binder does not again soften after the initial baking process, but it is not yet easy to obtain consistent grades of bakelite to withstand the onerous conditions of naval service. Other insulating materials used in naval

* L. J. Steele and H. Martin: "The 'Cyc-Arc' Process of Automatic Electric Welding," *Journal I.E.E.*, 1922, vol. 60, p. 136.

work, such as tapes, oils, varnishes, &c., are, in the main, the same as those used in ordinary commercial work.

Secondary Batteries.—The use of batteries in surface warships is comparatively limited. The electricity supply to the gunnery and torpedo control circuits, telephones, and certain navigational instrument circuits necessitates small batteries as a stand-by; they are also employed for auxiliary lighting in certain important spaces, such as gun houses, while they are also used for wireless purposes and for portable hand-lamps; for the last-named apparatus alkaline cells are being used to some extent. In submarines the whole of the power for underwater propulsion is provided by this means, and the onerous conditions of working make the provision of a reliable battery an extremely difficult problem. In a modern submarine the number of cells varies in different navies according to the voltages used, the capacity of the cells ranging from about 2,000 to over 10,000 ampere-hours (5-hour rate).

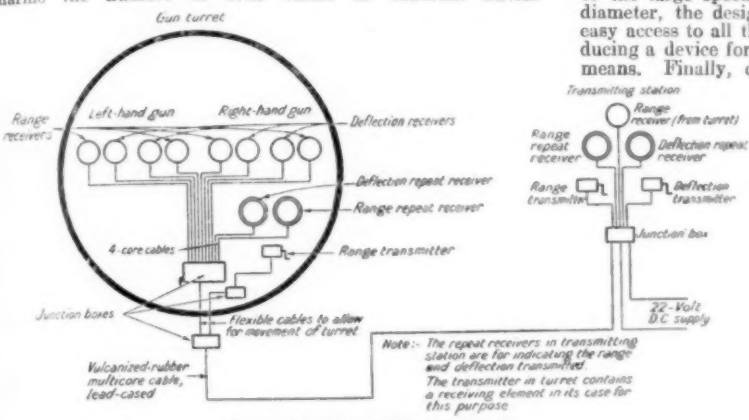


Fig. 6.—Range and Deflection Circuit.

The limited floor space available has necessitated the adoption of a cell of great length, compared with its lateral dimensions, totally enclosed except for a ventilation hole at the top. The plates are supported by the terminal lugs from the lids of the containers. All navies have experienced difficulty in obtaining satisfactory containers. Later types are of a special quality of ebonite, and in one case a bakelite product is being used successfully. Some difficulty has been experienced in so adjusting the composition that the containers will not deform when carrying the weight of the plates at temperatures up to 140 deg. F. and will not be brittle at lower temperatures. The necessity for packing the cells very tightly together imposes quite rigorous limits of accuracy in the manufacture of containers, the tolerance allowed being only 1/16th in. on any of the overall dimensions. Since 1911 pasted plates have been employed, and the rapid increase in the capacity/weight ratio which occurred about the year 1914 resulted in a battery with a very short life, from about 2 to 3½ years, although in especially good cases a life of 5 years has been obtained. The average condition of condemned pasted positive plates may be represented as follows:—

The lower third of the plate—all active material gone.
The middle third of the plate—50 per cent. of active material gone.
The upper third of the plate—25 per cent. of active material gone.

Although no satisfactory explanation is forthcoming, it may be connected with the very uneven current distribution consequent on the use of long, narrow plates; unless a cell is provided with some reliable mechanical means of preventing this shedding, it cannot be expected to give satisfactory service in a submarine. In proximity to the engines and in the tropics sulphation troubles sometimes arise, and there is increasing evidence that with the new types of cell, in which support is given to the positive paste, ultimate failure may be due to sulphation of the negative paste. It is customary in different navies to employ a lower acid density in the tropics than in temperate climates, the figure adopted generally corresponding to 1,210-1,220 at 60 deg. F.

It is desirable to regard ventilation as separate from the cooling, although they may be combined. In the later batteries used by several navies the closed cell is employed, the gases from each cell being led by small pipes into larger ones and thus exhausted. At the same time, air is drawn over the tops of the cells; very little cooling effect can be obtained through the container walls owing to their low heat conductivity, but the large mass of metal exposed at the top of the cell in the terminals and inter-cell connectors enables a considerable cooling effect to be obtained by this means.

Submarine Problems.—The submarine is an electrical ship, the electric motor having provided the best solution for underwater propulsion. To indicate the amount of electrical apparatus installed in a submarine, it may be stated that its weight is not less than 14 per cent. of the underwater displacement of the ship; the weight of the battery is about 7 per cent. A normal electrical output would be of the order of 1,400 s.h.p. developed on two propellers. When separate battery-charging generators are used, this output would be maintained at all speeds of the ship; that is to say, a propelling motor would be installed on each shaft to develop 700 b.h.p. at all speeds from, say, 250 to 400 r.p.m. at 300 volts. The motors are usually double-armature machines, with series-parallel battery grouping, which arrangement is well suited to the large speed-range necessary. Of an unusually small diameter, the design has also to incorporate some method of easy access to all the field poles and windings, either by introducing a device for turning the field frame on rollers, or other means. Finally, dissipation of the heat has already been satisfactorily accomplished by totally enclosing the motors and water-cooling the circulating air. The number of electrically-driven auxiliaries may be about 60, of capacities of 70 b.h.p. down to very small powers. Distribution is effected on the ring-main principle. Pressures of 120 to 230 volts, according to the type and nationality of the submarine, are used, and in consequence the currents to be dealt with are very high, and a number of large cables per pole may be required for portions of the ring-main system; power cables are usually tough-rubber-sheathed outside the pressure hull of the submarine, and special designs of glands and fittings have to be used to withstand high water pressures during submergence. Various warning alarms and the usual telegraph indicators and telephones are usually similar to those used in surface ships, and are operated from the 22-volt supply obtained from motor-generators.

Wireless Telegraphy and Telephony.—A large ship contains a number of wireless sets designed for different purposes; spark sets, arc sets, and valve sets, for both Morse and telephony, are used, the transmitting circuits ranging from about 15 kW to a fraction of 1 kW. The necessary power is usually obtained from the ship's d.c. supply through motor-alternators or rotary convertors, and step-up transformers. The high pressures and frequencies employed introduce special problems: examples are the special aerial trunks between decks, and the very thorough bonding and earthing (*via* the lightning conductor) of all isolated metal work on masts and yards, and the ends of wire stays and shrouds.

"Low-power" Apparatus.—A large amount of apparatus in a warship cannot conveniently be supplied direct from the lighting and power circuits. Some of this requires alternating current and some direct current; the pressure may be anything up to 100 volts, but by far the greater part is supplied at 22 volts d.c. by motor-generators *via* control

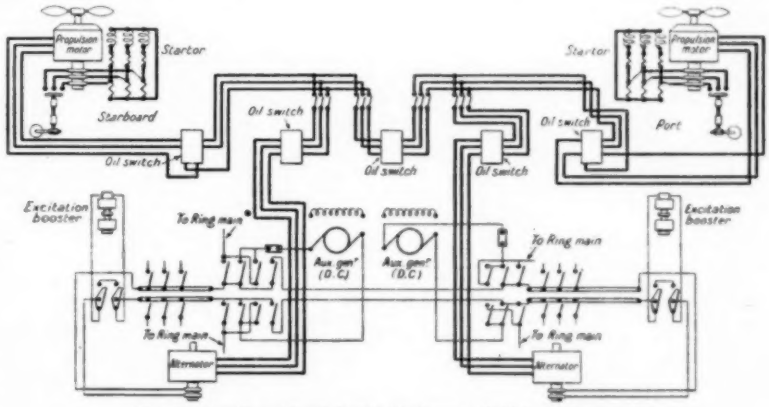


Fig. 7.—Auxiliary Diesel-electric Equipment, H.M.S. "Adventure."

apparatus and distributing panels feeding circuits grouped as follows:—

(1) Fire and torpedo control circuits; (2) telephone circuits; (3) miscellaneous low-power circuits such as bells and gongs, buzzers, rattlers, turbine and telegraph direction tell-tales, &c.; (4) gun and torpedo firing circuits.

In some cases any generator can feed any group normally run independently, and batteries, which normally float in parallel with their associated generators, can take over the load in the event of failure of the motor-generators. In the largest ships the capacity of these batteries may be some 500 ampere-hours at the 5-hour rate. Examples of low-power apparatus which is not supplied from the 22-volt installation referred to, but has its own motor-generator, are (1) hummers;

(2) bearing indicators for guns and searchlights; (3) turret danger signals; (4) gyro-compass and repeater circuits.

The control of guns, torpedoes and searchlight is complex, of great variety, and confidential.

The type of instrument most largely used is a simple step-by-step motor with unwound armature, in the stator of which a rotating field is produced by means of a commutator type of transmitter supplied with direct current. The rotor moves in steps of 15 deg., so that it has to be geared down considerably to obtain the accuracy required. The main installation consists of a multiplicity of such instruments and the necessary circuits of multi-core cables with their connection boxes, change-over switches, &c. For searchlights and certain other purposes where the accuracy required is not quite so high as for the guns, another method works on the Wheatstone bridge principle. In addition, numerous step-by-step indicators are employed for the passing of orders, ranges, and other information; a simple range and deflection circuit is shown in fig. 6.

For the electrical firing of guns by current growth to the value required to heat a fusible bridge and the surrounding pad of inflammable material to the ignition point, the circuits are usually made single-pole with an "earth" return. A most elaborate system of auxiliary apparatus, mostly electrically operated, into which the gyroscope enters to a large extent, is usually provided to assist the gunnery officers to make good practice.

Telephone communication is provided between all important stations and, in addition, between offices, cabins and other compartments. In a large modern warship there may be up to 700 telephones, of which some 370 are on the various exchanges with "trunk line" connections. All telephones are supplied from the low-power board; two wires per instrument are now generally used, and to prevent communication noises and cross-talking, inductive "line coils" are included in the supply to each pair of telephones, which also serve as relay coils; non-inductive shunts, or condensers, provide a path for the oscillating currents. Special loud-speaking telephones are used in particularly noisy compartments, or for "broadcasting" purposes.

Electric Propulsion.—The chief considerations are flexibility, weight, space and economy. The geared turbine drive certainly lacks flexibility. The economy of an electric drive can be made to approximate to that of a geared drive. At full power the efficiency of turbo-electric transmission is usually somewhat lower than that of a geared turbine drive. At lower powers, such as are required for cruising, the efficiency of the electric drive is usually higher than that of the geared turbine. The ability to drive all propellers at low speed from one generating unit only, appears to be an advantage from the military standpoint as well as from that of economy. The fullest use of science and skill must continue to be made by electrical engineers, in conjunction with marine engineers, if the well-established and efficient mechanical transmission is to be more than equalled with regard to (*a*) full speed of the ship, (*b*) weight, (*c*) space occupied, and (*d*) cost.

In *H.M.S. Adventure*, an auxiliary ship of approximately 8,000 tons displacement, Diesel-electric propelling machinery for cruising speeds has been installed, fig. 7. The power developed on each shaft is approximately 2,100 s.h.p. at a propeller speed of 160 r.p.m. A three-phase a.c. system is adopted, the pressure being 1,100 volts between phases. Two three-phase high-speed induction propelling motors are used, one for the port and one for the starboard side of the ship; each is normally supplied from its own alternator, which is directly coupled to a Diesel engine. The two 343-r.p.m., 1,650-kW alternators do not run in parallel; under emergency conditions, however, it is possible to run both motors from one alternator, or the port motor from the starboard alternator, or *vice versa*. The motors have wound rotors and are brought up to speed by the use of reactance-resistance starters. Special provision is made for over-excitation of the alternators by the use of a novel type of automatic booster to meet the conditions of temporary or periodic overload due to heavy weather or similar causes.

The control of the motors and alternators is carried out by oil-break switches, with operating mechanism on the control platform in the Diesel-engine room. The control and operation of the plant has been so arranged that the whole sequence of operations is carried out by means of a single hand-wheel for each side of the ship, the usual protective devices being fitted. The paralleling of the alternators is prevented by mechanical interlocks. The installation is as simple as can be arranged; instruments of various types have been provided to supply all possible information for the study of the performance under varying conditions.

Miscellaneous Electrical Appliances.—There remain a number of miscellaneous applications which, although not large in themselves, are none the less important. Included in this category are gyro-compasses, hummers, rattlers, buzzers, turbine and telegraph direction tell-tale, Forbes log, turret danger signals, Röntgen-ray apparatus, electrically-driven domestic machinery, such as kneading machines, mincers, and laundry machines, electric torches and portable accumulator hand-lamps, electrically-driven printing machines, &c. The accumulator hand-lamps resemble miners' lamps, and are used for magazines and danger spaces; the alkaline cell is finding increasing favour for portable apparatus of this character.

Finally, as a last example of the extent to which a large variety of modern electrical apparatus has been adapted to naval needs, electric starting and lighting sets at 12 volts, on the general lines of motor-car equipment, find their application afloat in the motor boats of the fleet.

Conclusion.—Electricity is not only an invaluable adjunct, but has become an integral part of a fighting fleet's structure. It is recognised that the greatest progress is made by a proper understanding of when and how co-operation with research and other workers should be effected, and by a vigorous development of experimental work; but, in the selection of the most suitable equipment for warship work, caution is necessary, for any defect arising at a critical period in action in machines or apparatus fitted in large numbers in vital parts of a warship's installation may cause consequential damage to the community which may have very far-reaching effects.

The author emphasises the difficulties imposed by limitation of space and weight, sea conditions, extremes of heat and cold, the claims of other services in the ship, and the difficulty of fitting in one requirement with another. So far as the British Navy is concerned, all these conditions are reflected in the detailed requirements of the Admiralty specifications. It is desired to place on record the willingness with which manufacturers in this country have co-operated in matters of investigation and development when invited to do so, and it is encouraging to know that much of the effort to meet naval conditions is not without its benefit to the electrical industry and is often reflected in commercial practice.

[The paper, which was illustrated with lantern slides depicting apparatus which has been devised for testing lamps and electrical gear for use in ships, and indicative of the damage ships are liable to sustain in action, includes instructive data in tabular form, together with a digest of the arguments for and against electric propulsion, which are, however, too lengthy for reproduction.—EDS. ELEC. REV.]

Electrical Development in Spain.

A Review of the Progress Made During 1926.

IN a recent issue of *La Energia Electrica*, of Madrid, Señor F. Gallego gives an interesting summary of the electrical progress in Spain during 1926. The most notable feature of the year was the decision of the Spanish Government to assist financially in the development of hydro-electric stations, which had previously had to be borne entirely by private enterprise. One of the first schemes to be assisted on a "fifty-fifty" basis is that of the Sociedad Canalizacion y Fuerzas del Guadalquiver, which is not only rendering the section of the river between Cordoba and Seville navigable, but will also provide electric power to the extent of about 62,000 h.p. The Government is also assisting, among others, a scheme of the Sociedad Hispano-Portuguesa de Transportes Electricos to utilise the power of the river Douro.

Among the new hydro-electric stations which were completed during the year is that known as La Vid, belonging to the Sociedad Hidroelectrica Legionese. The plant utilises the water power of the river Porma, and although only 700 h.p. is so far available, this is to be extended to 1,400 h.p. in the near future. At La Jorquera, in the province of Albacete, the plant which utilises the power of the Dornajos falls was extended from 2,000 to 4,000 h.p. At Olloniego (Asturias) the Sociedad Electra de Olloniego completed a 1,000-h.p. station on the river Nalon, the power generated being transmitted to Mieres and Tudela-Veguin. The Sociedad Hidroelectrica de Navarra completed a 1,500-h.p. plant on the river Garganta de Tormes, in Avila Province, while at Bidasoa (Navarra Province) the Sociedad Hidroelectrica de Lombilla put a 3,200-h.p. plant into operation. A small 300-h.p. hydro-electric station was also completed by the municipal authorities of Deva (Guipúzcoa).

Many of the old-established electricity supply undertakings also carried out further extensions. The Sociedad General Gallega de Electricidad extended its 70,000-V transmission lines to Santiago, Villagarcia, Pontevedra and Vigo. The Sociedad Sevilla de Electricidad is making good progress with the establishment of its new 4,000-h.p. hydro-electric station at Cala, 20 miles from Seville, and it is expected that the plant will shortly be put in operation. The Sociedad Hidroelectrica de Castilla is engaged on the construction of a dam to collect the water of the Villalba de la Sierra falls, which will render 15,000 h.p. available. The Sociedad Salto del Cortigo is establishing a hydro-electric station on the river Ebronea, near Fuenmayor (Province of Logrono). The Sociedad Hidro-electrica Espanola is increasing the plant at its station at Villora (Cuenca Province) up to a capacity of 47,400 h.p.; the transmission line between the station and Madrid is being altered to transmit power at 130,000 V instead of at 25,000 V. The Sociedad Energia y Industrias Aragonesas, whose station at Biescas, on the river Gallego, has a capacity of 10,000 h.p., has established a 60,000-V transmission line to supply a number of industrial works in the Sabinago district. During the year the Sociedad Hidroelectrica del Cantabrico installed two further 3,300-kVA turbines and generators at its station at

Sorniedo, bringing the capacity up to 14,000 kVA; three 5,000/50,000-V transformers, one of which is held in reserve, were also installed. The company has also erected a 50,000-V transmission line between the power station and the State gun factory at Trubia. A transmission line is also being erected between the sub-station at Naranco (Oviedo) and the distribution system of the Sociedad Co-operativa Electrica de Langreo, with the view of an interchange of power between the two concerns, whenever it becomes necessary.

La Sociedad Union Electrica de Cataluna completed a 40,000-V transmission line between the hydro-electric stations at Tremps and Pobla de Segur in Catalonia. The Sociedad Fuerzas Motrices del Ville de Lecrin completed a number of 6,000/220-V transformer stations for the supply of power to seven small towns. A 25,000-V line, about 20 miles in length, has also been completed between the sub-station at Santafe de Mondujar (Almeria) and the mines of the Sociedad Minera en Lucainena de la Torres, where a 25,000/2,100-V transformer plant has been installed. La Sociedad Electrica Industrias Corunesa has added a new 1,200-kVA transformer to its power station at Capela, and one of 500 kVA at the sub-station at La Coruna. A second transmission line has also been erected on the existing masts. The Co-operativa de Fluido Electrico of Barcelona is establishing a steam-operated station at Adrall, and also proposes to erect a plant to utilise the water power of the Cadi falls. Work has also been commenced by the Sociedad Electrometalurgica Iberica on a 30,000-h.p. plant to utilise the power of three falls at El Burguillo.

As regards electric traction a new 3¾-mile section of the underground railway in Barcelona was completed, as also were a local electric railway 12½ miles in length between Vigo, Romallosa and Bayona; a new branch line between Palma de Mallorca and Estabiishment, and a cable railway between La Reineta and San Salvador del Valle, 1,312 yards long, with a rise of nearly 400 ft. The electric traction work in progress comprises further extensions of the Barcelona underground railway, the Vitoria-Estella railway, and the electrification of the Spanish section of the Trans-Pyrenéen railway from Ripoll to Aix-les-Therms and from Bilbao to Las Arenas and Plencia. The Northern of Spain Railway Co. is also electrifying the line between Barcelona and Manresa.

Señor Gallego concludes with a table showing that there are now one hundred hydro-electric stations in operation in Spain with a capacity of over 1,000 h.p. each, the total power at present utilised in the country being 758,150 h.p., while in a second table he gives brief particulars of further hydro-electric projects totalling 3,199,900 h.p. for which concessions have already been granted or in respect of which plans are in course of preparation.

Indian Electrical Notes.

(From Our Indian Correspondent.)

Electrical Trade in 1926.

THE year 1926 has again recorded a notable increase in the imports of electrical machinery and apparatus into India. The imports of electrical machinery increased in value from 209 lakhs in 1925 to 248 lakhs. Generators and dynamos increased from 34 to 52 lakhs, transformers from 13 to 28 lakhs, and turbo-generator sets from 15 to 20 lakhs; but control and switchgear declined from 38 to 36 lakhs, and motors from 36 to 31 lakhs. The United Kingdom's share of the trade rose from 174 lakhs to 203 lakhs. The United States and Germany have also recorded increases, the former from 17 to 20 lakhs, and the latter from 9 to 10 lakhs. The trade in electrical apparatus amounted in value to 240 lakhs, as against 227 lakhs in the previous year. This trade has shown steady increase during the last three years. The share of the United Kingdom, however, remains the same as in 1925, *i.e.*, Rs.158 lakhs, but compared with 1924 it shows an increase of 20 lakhs. All other countries were able to increase their shares, notably the United States, imports from which rose from 20 lakhs to 33 lakhs. Germany also increased her share by about 1 lakh to 23 lakhs. It appears that the increase in the trade is taken up almost entirely by the United States. The imports of electric wires and cables amounted to Rs.80 lakhs, almost the same as in the previous year, but the United Kingdom's share declined from 73 to 69 lakhs. Electric fans increased from 28 to 31 lakhs, electric lamps from 21 to 30 lakhs, and accumulators from 12 to 14 lakhs. The imports of radio apparatus amounted to 5 lakhs in value, almost the same as in the previous year. About 4½ lakhs' worth came from the United Kingdom.

Radio Apparatus Import Regulations.

The following instructions regarding the importation into India by private persons, of apparatus for radio-telegraphy have been issued by the Government of Bengal:—

1. Radio apparatus may not be imported into British India without an import licence, which is issued by the Director-General of Posts and Telegraphs. 2. Persons, who are not dealers in radio apparatus, may, however, be allowed to import on temporary permit apparatus not exceeding one complete receiver (or its component parts) and necessary spares. This temporary permit may be obtained from the competent Customs officer on presentation of an application in the prescribed form to which postage stamps to the value of 10 rupees have been affixed. 3. This fee of Rs.10 is the annual fee for an import licence, and is additional to any Customs duty which may be leviable on the imported apparatus. 4. The import licence will be forwarded subsequently to the applicant by the Director-General of Posts and Telegraphs, and will be valid until December 31st of the year of issue, unless dated on or after November 1st in any year, when it will remain valid for the whole of the following year. Item 4 in the application form should therefore include all apparatus that the applicant intends to import during the validity of the licence and not merely the apparatus in respect of which the temporary permit is required. 5. Transmitting apparatus may not be imported on a temporary permit, and Customs officers are not authorised to accept application forms except on the conditions contained in para. 2 above. In all other cases the application form, after completion, should be forwarded by the applicant to the Director-General of Posts and Telegraphs (Wireless Branch), Simla, to whom all other inquiries regarding importation of radio apparatus should be addressed.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Wessex Electricity Bill.

This Bill, the purpose of which is to incorporate and confer powers upon the Wessex Electricity Co., was before the Unopposed Committee of the House of Lords on April 5th, and was ordered to await report. The Bill authorises the company to raise capital to the extent of £750,000, and to borrow to the extent of half the amount of capital issued. The basic dividend is to be 8 per cent. per annum, and power is given to increase the dividend paid in accordance with decreases in the price charged for electricity. The first directors will be Sir Philip Dawson and Messrs. G. I. Phillips, F. M. Rogers, G. C. H. Hamilton, H. W. Couzens, J. H. Edwards, F. N. Curzon, and H. C. Hambro. The company's area of supply will include parts of the counties of Oxford, Bucks, Berks, Southampton, Wilts, and Gloucester.

Yorkshire Electric Power Bill.

The Unopposed Committee of the House of Lords, on April 5th, ordered this Bill to be reported for third reading. The main purpose of the Bill is to enable the company to raise additional capital of £2,000,000 (nominal), and power is also given to borrow up to one-half the nominal amount of the additional capital which at the time of borrowing has been raised and of which not less than one-half has been paid up. The borrowing powers in respect of the existing capital are also increased from one-third to one-half the amount. (The capital authorised by the company's existing Acts is £4,000,000.)

Pacific Cable Bill.

On March 30th, Mr. AMERY, Secretary of State for the Dominions, moved the second reading of the Pacific Cable Bill, which consolidates, with amendments, the Pacific Cable Acts, 1901-1924. He explained that the Bill embodied agreements arrived at during the Imperial Conference by the Governments concerned in the administration of the Pacific cables on certain matters affecting both the constitution and organisation of the Pacific Cable Board and the financing of the undertaking. The two main points on which the present measure changed previous legislation affected the constitution of the Pacific Cable Board and the building up of the reserve fund. The Board was an organisation on which the Governments of Great Britain, Canada, Australia, and New Zealand were represented. On the Board the interests of Great Britain were represented by three members out of seven, and also by the right of the Treasury to appoint the chairman. This preponderance of British control in a joint venture was due partly to the fact that the original capital of £2,000,000 required for the construction of the first cable was advanced on loan by the Treasury, and it also reflected the conception of 25 years ago with regard to the natural position of dominance which the Government should occupy. When the first cable was completed in 1902, it was provided that £77,000 a year should be devoted to payment of interest and sinking fund on the original advance of £2,000,000 made by the Treasury. During the early years between 1902 and 1914, there was a regular loss, which amounted to £713,000, but in 1914 and 1915 the situation changed, and since then the Pacific cable system had shown a regular and substantial profit. In 1911 the Board thought it was desirable to supplement the original cable by an additional cable between Australia and New Zealand, and an Act of Parliament was passed enabling the reserve fund to be used for that purpose. It became evident

that a further cable would be required, linking Fiji with New Zealand, and also with Australia, and that the system would have to be duplicated owing to the increased volume of traffic. In 1922 it was decided to lay a cable of the newest type, and it was completed, linking Australia and New Zealand with this country, *via* Canada. After the present year, the sum of £10,000, or one-tenth of the year's surplus, whichever was the larger, was to be placed in the reserve, subject to the provision that the reserve might be further increased or diminished by consent of the partner Governments. In the next two years, after the present year, after that contribution was paid over to reserve, the surplus, if any, would be distributed among the partner Governments. After the next two years the surplus would be equally divided between repayment of the original capital and distribution among the partner Governments. They were now in a position to accelerate the repayment of the original £2,000,000, a sum that was now reduced to a total of £1,270,000. By so doing they would set free a larger surplus, either for a further reduction of rates or for a distribution of profits among the Governments concerned. The service was an invaluable asset to the commercial development and the security of the British Empire. The Bill was read a second time.

London Joint Electricity Authority Bill.

The Standing Orders Committee of the House of Lords, on April 7th, considered an application that Standing Orders be dispensed with in the case of the London and Home Counties Joint Electricity Authority (No. 2) Bill. The Examiner had reported that the Standing Orders had not been complied with, inasmuch as the notices were not published and the deposits were not made until March, 1927, instead of the dates prescribed. The application was opposed by the Barnes Urban District Council.

Mr. HARRY G. PRITCHARD said that one of the main difficulties with which the Authority had to contend was that its area was divided into no fewer than 86 different electricity areas, each with its separate electricity undertaking; the supply of electricity in the area was derived from 60 generating stations, many of which were old and very uneconomical to run. It being recognised that the proper method of providing a supply was to have well-situated, well-equipped generating stations, where generation could be carried on in large units in a wholesale manner, the Authority had decided to erect a station, as, indeed, it was bound to do. It was advised that the station should be in the western part of the area, as that was the centre of the greatest demand at present; that it must be situated on the Thames, in order that there should be an adequate supply of water; and that it must adjoin a railway. The Authority considered that the site which it had selected was the only really suitable one. It was about 45 acres in extent, and was situated at Duke's Meadows, Chiswick. The Chiswick Urban District Council had agreed to sell the land, but had imposed certain conditions. One condition was that, inasmuch as the land was intended to be used as playing fields, the Joint Authority must provide another open space in substitution for it. The Joint Authority had made a provisional agreement with the Duke of Devonshire, who owned that land, for its purchase, if Parliament agreed to the proposal in the present Bill. Another condition was that the Joint Authority should provide a promenade walk between the station and the river. There was a town-planning scheme for the area, and the proposed site could not be used unless that scheme were amended. The Joint Authority had anticipated that these arrangements could be carried through under the general law and without further statutory authority, and it had applied to the Electricity Commissioners for approval of the erection of the station. The Chiswick U.D.C. applied to the Ministry of Health for its approval, but after inquiry the Minister decided that he could not give his consent to the modification of the town-planning scheme, and, in effect, he had invited the Authority to put the matter before Parliament. The Authority had been pressed for time, and steps had to be taken somewhat hastily. When its first Bill came before the Examiner a memorial was presented by the Barnes U.D.C., and the Examiner held that the Standing Orders had not been complied with in some respects. After consideration, it appeared that the best course would be to discontinue the promotion of the Bill and to commence the proceedings *de novo* by the promotion of a late Bill, in regard to which the Standing Orders would be complied with in their entirety, except, of course, with regard to the dates of deposits and notices. The Examiner was satisfied with the present Bill, and he (Mr. Pritchard) asked the Committee to allow the Bill to proceed. The only opponent was the Barnes U.D.C., which was not the local authority for the area in which the site was situated. Finally, he pointed out that if the present Bill were not allowed to proceed, another Bill would be promoted next session for the same purpose. That would lead to additional expense.

Mr. H. E. SWALLOW, on behalf of the Barnes Council, said that the fact that the Barnes U.D.C. was the only opponent to the proposal to dispense with Standing Orders was no indication whatever of the magnitude of the opposition to the Bill itself which would be forthcoming in Committee if the Standing Orders were dispensed with. The land on which it was proposed to erect the generating station had been the subject of inquiry previously. In 1914 the Brentford Gas Co. had sought powers to acquire compulsorily part of the land for the erection of gasworks, but the proposal was rejected by Parliament. In 1918 the Brentford Gas Co. proposed to use a site in the same neighbourhood for the erection of gasworks, but the proposal was opposed by various interests, and was withdrawn. Again, in October last, the Ministry of Health had decided not to amend the town-planning scheme. That scheme was designed just as much in the interests of Barnes as of Chiswick. The Minister of Health did not consider that the land should be allowed to be used unless no other suitable site could be found for the purpose without involving a material increase in the cost of the proposed electricity service, and it did not appear to him that that had been demonstrated. If Standing Orders were dispensed with, there would not be sufficient time remaining in the present session to enable Parliament to consider the substantial opposition that there would be to the proposals in the Bill. If promoters of private Bills, which did not comply with Standing Orders, were to be entitled, even on the ground of urgency, to promote a late Bill, it might lead to serious laxity in giving proper notice to persons interested, and would greatly reduce the protective value of the Standing Orders.

Mr. PRITCHARD said that there were many Bills which had not yet been passed by Committees of the House of Commons, and would have to come before Committees of the House of Lords, and he considered it highly probable that the present Bill would catch them up. So far as he knew, there were no precedents for the procedure now suggested in *recent* times, but there were, in fact, precedents. The promoters of previous schemes had not undertaken to provide an alternative site for public pleasure grounds, and had not received the approval of the local authority, as the Joint Authority had done in this case.

The Committee agreed to recommend that Standing Orders be dispensed with.

Private Bill.

The Hastings Tramways Company (Trolley Vehicles) Bill has been read the third time in the House of Commons.

Electrical Artificers.

On April 1st, Mr. HORE-BELISHA asked the First Lord of the Admiralty what was the strength of the electrical artificer branch.

Lt.-Col. HEADLAM, Financial Secretary to the Admiralty, said that the numbers borne on March 15th were:—Electrical lieutenants, 4; commissioned electricians, 26; warrant electricians, 31; chief electrical artificers, 197; electrical artificers, 760; apprentices, 138; total, 1,156.

Answering a further question, Lt.-Col. HEADLAM said that an examination for the rank of warrant electrician was held on March 31st and April 1st, and it was the intention that normally an examination should be held annually in future. The last previous examination was held in March, 1922.

Electricity Charges at Pontefract.

On April 5th, Brigadier-General BROOKE asked the Minister of Transport whether he was aware that the Yorkshire (West Riding) Electric Tramways Company, which supplied electric light and power in the Pontefract area, was still charging the increase of 15 per cent. which was imposed in November last; and whether, seeing that the price of coal had been in process of reduction since that period, and in view of the lower comparative charges in towns neighbouring on Pontefract, he would refer the matter for inquiry to the Electricity Commissioners.

Colonel ASHLEY said that the question of electricity charges in Pontefract had already been the subject of correspondence between the Electricity Commissioners and the company, which had intimated that the 15 per cent. increase would be withdrawn on April 30th. The Commissioners were still in communication with the company on the question of comparative charges in the neighbouring towns.

Coal-Handling Plant in India.

Among the equipment of the new Garden Reach plant of the Calcutta Electric Supply Corporation, Ltd., is a complete electrically-operated coal-handling plant supplied by Messrs. W. J. Jenkins & Co., Ltd., Retford. According to *Commerce* (Calcutta), the coal upon arrival is discharged into a specially-constructed pit with a capacity of about 100 tons. At regular intervals an electric 2-ton grab transfers the coal by way of a telpher to receiving hoppers, which feed a breaker. Upon being broken to suitable size, the coal passes through a rotary filler into the buckets of an endless conveyor. Reaching a specially-constructed tower, the coal is elevated to a height of 40 ft., and then continues horizontally until it reaches the bunker hoppers, being automatically weighed in the process. Here the buckets are mechanically tipped. Immediately beneath each bunker hopper is a raised platform complete with track on which run two weighing and delivering machines electrically driven. These machines receive the coal from the bunkers and deliver it to the respective furnaces as required. The whole plant is capable of dealing with 50 tons per hour. The ash is removed by a similar labour-saving arrangement.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Testing Three-wire A.C. Networks.

A correspondence on the testing of three-wire a.c. networks would be very useful. One can test d.c. networks by Raphael's method, which reveals neutral faults very efficiently, but this does not appear to apply to alternating-current systems. The usual method is to put first one side of the system directly to earth and then the other side. This can only be done by breaking the neutral connection to earth, an undesirable thing to do, as the neutral ought properly to be bonded very strongly to earth so that if the high-pressure windings should happen to come into contact with the low-pressure windings in the transformer, the circuit breaker would be opened at once. Perfect safety is best assured when there is no switch between the neutral and the earth connection.

The method of putting the outers to earth at frequent intervals has other objections. It is crude and unscientific, and will tend to breed faults by putting an undue stress on the installations connected. Yet if there are no other methods available one must just do it.

Faults.

April 6th, 1927.

Municipalities and Foreign Tenders.

The decision of the Manchester Corporation to place a contract with a foreign firm, and the report of the proceedings leading to this decision, make interesting reading, and confirm the opinions expressed by the writer in your "Correspondence" columns some time ago.

It is about time that our municipalities woke up to the fact that price-fixing associations are taking undue advantage of the specious plea that placing orders at home provides more employment. The fact is that groups of manufacturers artificially fix prices which bear no relation whatever to the cost of production, and the ratepayer is "fleeced" in order to swell profits and subsidise shareholders.

Further, to encourage the formation of price-fixing groups is to put a premium on inefficiency, at a time when every means should be adopted to reduce costs of production if we are to compete in the world's markets.

Those who talk glibly of the glories of free and open competition seem to be the very people who wish to eliminate competition by the formation of rings and combines.

It is to be hoped that Manchester, true to its traditions, will have set a good example to other municipalities in the struggle for economy.

Salesman.

April 9th, 1927.

River Water—or Cooling Towers?

We have read with interest the article published on January 14th, 1927, in your paper on "River Water or Cooling Towers?" by Mr. J. N. Waite, M.I.E.E.

We should like to communicate with the author, as we have had considerable experience in cooling towers and have also some data on the cost of operating with river water as compared with cooling towers.

We might state that here, in New York, one of the large ice manufacturing companies has plants in different sections of the city, and in one case it operates its ammonia condensers with river water and in the other case with cooling-tower water; in both cases the power is obtained from the electric service company. The cost of energy figured on the basis of kWh per ton of ice produced shows a considerable reduction in favour of the cooling tower. We have monthly records in both plants, which make a very interesting comparison.

Referring to Mr. Waite's article, we note that he bases his calculation on the temperature of water from cooling towers being 75 degrees with 45-degree wet bulb, or 30 degrees difference between the wet bulb and the water. In a modern efficient cooling tower the difference should not be over 10 degrees.

He also does not state that the temperature of river water may be higher in the winter time than cooling-tower water, and lower in temperature in the summer. In many cities the current requirements are greater in the winter than in summer. We believe a closer study on the part of Mr. Waite, covering average yearly conditions, might show a cooling tower more efficient than river water; this may not be true in every case, but is probably very certain in many cases, especially in the South. The most important consideration is to have the cooling tower properly designed and of *ample* size to cool to within 5 to 10 degrees of the wet bulb under the worst atmospheric conditions.

Edwin Burhorn Co.

New York, U.S.A., *March 31st*, 1927. E. BURHORN, *Pres.*

The Salaries of Engineers.

Following with interest the correspondence which has been published by you during the past few weeks, relative to the low salaries in the engineering profession, one of the most cogent phrases—to my mind—in any of the letters was in that written by "P.W.," in which he stated "that he was referring to engineers' salaries outside the E.P.E.A." He has, in that phrase, pointed with no uncertain finger to the remedy for low salaries—*i.e.*, organisation.

The definition of an Association is "A body of men banded together to do something." This the E.P.E.A. has taken to heart, and it has worked unceasingly towards raising the status of engineers, first, by claiming on their behalf an adequate salary for services rendered and successfully negotiating the present National Joint Board Schedule for the electricity supply industry.

The E.P.E.A. has a strong nucleus of members who are *not* electricity supply engineers, of which I am one, and it has been successful in raising their salaries and improving their conditions of employment.

Until engineers realise that it is only by becoming active members of an association that they can work out a solution to their own problems, "Poor Blighter" and others will be able to pen such a series of letters as those which have appeared under the above heading.

If these gentlemen would spend their time and energy in an association, bearing in mind the definition previously quoted (and "P.W." has pointed to the appropriate organisation, *i.e.*, the Electrical Power Engineers' Association), then the writer is convinced that they would—in time—be able to subscribe themselves similar to himself—

Satisfied E.P.E.A.ite.

April 8th, 1927.

Legal.

Lord & Shand v. Webb.

AT the Plymouth County Court, on April 6th, Messrs. Lord and Shand, electrical contractors, sued Mr. W. H. Webb, builder, for moneys due for alterations and repairs to electrical installations in two of the defendant's houses. For the plaintiffs it was stated that the installations were put in by them, the original quotation being £16. The defendant later ordered two-way switching for which an extra charge of 7s. 6d. per house was made. A payment of £16 only had been made. Subsequently, complaints were made that the installations were faulty, and it was discovered that at one house a nail had been driven through the cable; the damage was repaired at a cost of £1 12s. 6d. At the other house the faults were found to be due to the dampness of the walls and for work in connection with that installation a charge of £2 8s. 6d. was made. The plaintiffs were now claiming the three amounts mentioned which the defendant refused to pay.

The latter stated that he understood that two-way switching was included in the original quotation. He had given no instructions for the remedying of defects in the wiring and said that he had never had complaints of dampness in houses which he had built.

His Honour Judge Gurdon accepted the plaintiffs' evidence as to the repairs and awarded them £4 1s.; the claim for two-way switching was dismissed.

Wareham Electric Supply Co., Ltd.

MR. JUSTICE ROMER, in the Companies Winding-Up Court on April 5th, again had before him the petition of Mr. W. E. Weston, of Hounslow, for an order for the compulsory liquidation of the Wareham Electric Supply Co., Ltd. It had been arranged that witnesses should attend for cross-examination if necessary, and that the whole of the facts concerning the company should be investigated. Mr. WILFRED HUNT, for the company, asked, however, for a further adjournment on the ground that his leader, Mr. C. A. Bennett, K.C., was unable to be present owing to illness, and also that the principal witness, whom it was desired to cross-examine—Mr. Eaton—was also too ill to attend that day, and would not be able to do so next week.

Mr. R. J. WILLIS, for the petitioner, said he was very anxious to have the whole matter thoroughly gone into, but he did not want to do it in bits, and he could not object to an adjournment on the ground of illness.

Mr. GALBRAITH, K.C., said he appeared for Mr. Edwards, a former voluntary liquidator of the company, who was present for the purpose of giving evidence if necessary. He agreed that it was a matter that must be disposed of once and for all.

Mr. WILLIS said that he would want to cross-examine Mr. Eaton.

Mr. HUNT suggested that the petition should stand over until the first company winding-up day next sittings. He said he would let the other side know in good time whether Mr. Eaton would be able to be present then.

His Lordship agreed to that course.

General Electric Co., Ltd., v. Currus Motor Accessories, Ltd.

A MOTION for judgment in default of defence in this action came before Mr. Justice Tomlin in the Chancery Division on April 5th.

Mr. TOOKEY, for the plaintiffs, said that the defendants had put in no defence. The action was for an injunction to

restrain passing-off in connection with the plaintiffs' trade mark "Osram" as applied to incandescent electric lamps and electric arc lamps.

His Lordship granted an order.

British Thomson-Houston Co., Ltd., v. Fox.

Mr. Justice Tomlin, in the Chancery Division on April 5th, had before him a motion by the British Thomson-Houston Co., Ltd., for an injunction restraining S. Fox, Bethnal Green Road, E., from infringing its patent for electric gasfilled lamps by selling lamps not of the company's manufacture.

Mr. Tookey, for the company, said that last Friday his Lordship granted an *ex parte* injunction. The defendant did not appear.

His Lordship granted the order.

Birkenhead Electrician Fined.

Summoned by the Birkenhead Corporation for preventing an electricity meter from registering the quantity of electricity supplied, Leonard H. Jackson, electrician, Birkenhead, was fined 40s., or 21 days, at Birkenhead recently. Evidence was given to the effect that when an inspector visited defendant's house he switched on the electric light, but found that whilst the power meter was "on" the light meter was "off." Defendant was running lights from the power meter and was only paying the power price.

Defendant said that a rod had dropped on the lighting wires, which became broken. He gave instructions for their repair, but the man who did the work evidently mistook the meters.

Reviews.

High Vacua. By G. W. C. Kaye, M.A., D.Sc., F.Inst.P., Superintendent of the Physics Department of the National Physical Laboratory. Pp. xii+175; figs. 91. London: Longmans, Green & Co., Ltd. 1927. Price 10s. 6d. net.

This volume is based on the Cantor Lectures which were delivered by the author during 1926. He has given an account both of the theory and of the appliances that are used in connection with high-vacua practice, which has not previously been done in so systematic a manner. The author's special training leads now and then to the introduction of valuable observations from his long experience.

If the history of scientific discovery is to a great extent the history of instruments, important discoveries have certainly followed every advance in vacuum technique. Those advances have been momentous during the last 20 years, chiefly owing to the researches of Gaede, Langmuir, and Dushman, of Knudsen in Denmark, and of Dewar and Campbell in England. The two fundamental principles of the physicist to-day are the structure of matter and the nature of radiation. The discovery of Röntgen rays, Coolidge tubes, hafnium, electrons, protons, isotopes, X-ray and positive-ray analysis, the cathode-ray oscillograph, thermionic valves, radio-communication, photoelectric cells, Dewar flasks, and even ordinary glow lamps would have been impossible without the improvement of vacua. It is difficult to state what the highest attainable vacuum may be, as all our measuring devices ultimately cease to operate, but it is assumed at the present time that the highest measured vacuum is of the order of 10^{-8} mm.

The main contents of the book consist of an introduction comprising a full survey illustrating the widespread utility of high vacua in the scientific and everyday world; an historical account of the development of vacuum pumps, vacuum tubes, and high-vacuum technique in general; a number of chapters dealing with backing and high-speed pumps and absorption methods of exhaustion; and, finally, two chapters dealing with high-vacuum gauges and the measurement of high-speed pumps.

The author exemplifies the large scale industrial applications of high-vacua pumps by referring to Sir Charles Parsons's pump and to the mercury-vapour pump used by Brown-Boveri for maintaining their high-power mercury-arc rectifiers at 0.01 mm. pressure; the rectifiers range up to 2,000 kW at 1,800 volts. The pump is of the bottle type, and is backed by a rotary oil pump; the whole system is insulated for high voltage, and is automatically controlled by a manometer and relays which start the heating and water-cooling and the backing pump. The "cleaning-up" of residual gases is effected by "getters," which are vaporised *in situ*. The evaporation probably produces intense ionisation and chemical activation, and the condensed film, afterwards deposited on the walls, holds the gas by absorption or trapping. In the case of electric lamps, the "getter" is an alcoholic solution of red phosphorus and a salt (sodium silicate), into which one end of the filament is dipped; the filament is then flashed. In valves a tiny strip of magnesium is volatilised by high-frequency induction; barium nitride is used in dull-emitter valves. Coming to high-vacuum gauges, they are described in considerable detail and are classified into five groups: (1) Those which depend on Boyle's law; (2) those which utilise the frictional drag of molecules on a moving surface; (3) those which measure molecular bombardment due to temperature differences; (4) those which depend on the fact that the thermal conductivity of a gas at low pressures becomes a function of the pressure; and (5) those which make use of the electrical conductivity of a gas. The chapter on pump speeds arrests attention by reason of its admirable discussion of many imperfectly explained operations, and is also rich in suggestions for further research. Evidently the whole problem interests the author intensely, the various methods and procedure that have been suggested being described accurately and in detail.

On the matters of which he treats the author offers the fruits of a ripe and unique experience, and he has also the faculty, which those who are masters of their subjects do not always possess, of describing essential features in simple terms. Dr. Kaye has made the best use of his wide knowledge, and has handled the subject not only with skilful discrimination, but also in a sober, scholarly, and scientific fashion.

The book is clearly printed, and some excellent illustrations and plates are included in the text, and much valuable information has been brought together in an attractive setting and in a form convenient for reference purposes. The author is to be congratulated on its compilation.

Makers of Science, Electricity and Magnetism. By D. M. Turner, M.A., B.Sc. Pp. xv+184; figs. 65. London: Oxford University Press. Price 7s. 6d. net.

This small volume is not confined exclusively to biographical sketches of the great outstanding personalities who have left their impress on the development of electrical science, but gives, in addition, brief outlines of the principal contributions which they have made to this development. Beginning, really, with Petrus Peregrinus in the thirteenth century, the author deals in chronological order with the work of Gilbert, of Colchester, and that of each of his successors who have carried the torch of science up to our own times. It is a fascinating record, and one which will bear re-reading over and over again, because of the personal and human element with which the author has invested it. It would seem invidious almost to select one or more of those whose work is dealt with here for illustrative purposes; but the manner in which the contributions to science by Faraday and Maxwell have been treated is all that one could expect within the limits to which the author has restricted himself.

The field covered includes electrostatics, the electric current, electromagnetism, electromagnetic induction, the development of electrical theory, electrolysis, the conduction of electricity through gases, and the electrical constitution of matter. In the last chapter we are brought right up to the work of J. J. Thomson, Bragg and Moseley on the connection between electricity and matter; but, in the words of the author, "if we ask 'What is electricity?' we are left with an unanswered question." It is somewhat surprising to find, however, no reference to the work of Eddington or of Jeans in the sphere of astrophysics, and the bearing that such work is having on our knowledge of the constitution of matter and of its relation to radiation; but probably it is of too recent a date to admit of its incorporation in the book.

An introductory chapter on the need for a History of Science is furnished by Dr. Charles Singer. There are 65 illustrations throughout the text, including a number of portraits; that of Faraday is particularly good. We heartily recommend the book as one which will be appreciated by the layman as well as the student of science.

The Elements of Radio Communication. By O. F. Brown, M.A., B.Sc. (Oxon.), B.Sc. (Lond.). Pp. viii+216; figs. 146. London: Oxford University Press. Price 10s. 6d. net.

Mr. Brown is connected with the Radio Research Board, and is thus in an excellent position for reviewing the latest developments of radio communication from the scientific point of view. He takes advantage of this fact by giving us in the last 50 pages an excellent summary of the up-to-date theories regarding directional reception, short-wave working, the propagation of waves and atmospherics. He says, we notice, in the directional portion, that the error of refraction in the case of waves crossing the boundary between surfaces of different conductivity can be allowed for; this is hardly so in practice as it varies with the distance between the stations. The remainder of the book consists of a non-mathematical summary of the theory of radio telegraphy and tele-

phony with a short summary of the principles of alternating currents as applied to radio circuits.

The author's difficulty is obviously how to cover the ground in the space at his disposal, and there is necessarily much omitted, such as machine telegraphy, methods of measurements, tuning-fork control, &c., which might be considered as coming within the scope of so comprehensive a title. We notice on page 43 that an earth screen is said to give better results than a buried earth, though it is known that this was not found to be the case in practice at the Rugby station.

The explanations are as a rule concise, lucid and free from mathematics except of the simplest kind. Some err, we think, from being so concise as to become sketchy, such as that of the Reinartz circuit on page 181, and we must confess to having difficulty in following the explanation of the magnetic amplifier on pp. 66 and 67, where a misprint of core for coil occurs, and of the elimination of distortion on pp. 160 and 165, where some of the letter references seem mixed. On p. 168, at the bottom, B is misprinted for B^1.

But these are minor criticisms; the book gives a good up-to-date summary of the principles of radio communication, and should be especially useful to electrical engineers who have not yet made a study of that branch of their profession.

Admiral of the Fleet Sir Henry Jackson, who is chairman of the Radio Research Board, in an appreciative foreword, confidently recommends this book "to those who wish to get a clear understanding of this useful and fascinating art."

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

22,793. "Alternating-current signalling systems." F. E. Pernot. September 12th, 1925. (267,189.)

23,668. "Automatic timing mechanism." Igranic Electric Co., Ltd., and J. H. Abbink Spaink. June 10th, 1926. (267,328.)

28,073. "Radio-telegraphic direction-finding and similar methods and arrangements." R. A. W. Watt and J. Robinson. November 7th, 1925. (267,575.)

28,456. "Electric switches." F. B. Cox. November 12th, 1925. (267,576.)

30,868. "Electric meters." F. H. Rogers (Republic Flow Meters Co.). December 7th, 1925. (267,583.)

30,978. "Dynamo-electric machines." D. Suchostawer. December 8th, 1925. (267,584.)

31,340. "Electric heaters." Thermo Path Co., Ltd., and A. E. M. Van Der Meersch. December 11th, 1925. (267,585.)

31,404. "Electric accumulators." H. Leitner. December 14th, 1925. (267,588.)

31,601. "Sparking plugs." A. J. Pearce. September 15th, 1926. (267,589.)

31,706. "Controllers for electric motors." A. West & Co., Ltd., and A. West. December 15th, 1925. (267,591.)

31,734. "Electric fusible cut-outs." W. H. Isherwood and R. T. Norton. December 16th, 1925. (267,593.)

31,860. "Cord or cable gripping devices for use with electrical sockets and plugs and the like." Walsall Hardware Manufacturing Co., Ltd., A. E. Read and C. G. Maisey. December 17th, 1925. (267,602.)

31,930. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. O. Passmore, and L. M. Simpson. December 17th, 1925. (Cognate application 15,624/26.) (267,606.)

31,959. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. Saville, and W. O. Passmore. December 17th, 1925. (267,608.)

31,961. "Flexible conductors." Standard Telephones & Cables, Ltd., and J. R. Pheasey. December 17th, 1925. (267,609.)

31,962. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables Ltd (G. Deakin). December 17th, 1925. (Addition to 232,726.) (267,610.)

31,963. "Adjustable telephone ear-pieces." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 17th, 1925. (267,611.)

31,998. "Current generating and controlling appliances, particularly applicable for use in electric arc welding." Quasi-Arc Co., Ltd., and A. P. Strohmenger. December 18th, 1925. (267,612.)

32,027. "Distribution and regulation of electrical energy." W. J. R. Calvert. December 18th, 1925. (267,613.)

32,060. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin). December 18th, 1925. (267,616.)

32,061. "Radio-receiving systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 18th, 1925. (267,617.)

32,091. "Electrolytic system." J. E. Noeggerath. December 19th, 1924. (245,119.)

32,245. "Electric transformers for wireless purposes." A. E. Watkins. December 21st, 1925. (267,619.)

32,262. "Illuminated signs." R. E. Ollerenshaw. December 21st, 1925. (267,622.)

32,297. "Oil-immersed electrical apparatus." A. Reyrolle & Co., Ltd., and H. W. Clothier. December 22nd, 1925. (267,624.)

32,857. "Electric connection devices." W. A. Brooke. December 30th, 1925. (267,640.)

32,981. "Loud-speaking telephones." G. Pelletier. December 31st, 1924. (245,457.)

1926.

66. "Dynamo-electric machines." Diamond Coal Cutter Co., Ltd., and P. Huggins. January 1st, 1926. (Patent of addition not granted.) (267,644.)

347. "Loud speakers for wireless receiving apparatus." F. M. T. Reilly. January 6th, 1926. (267,647.)

321. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., H. Adams, and H. D. Sharpe. January 7th, 1926. (Cognate application 6,940/26.) (267,648.)

778. "Method and arrangement for braking the wheels of a tramcar from the driver's seat on the motor-car." J. Schlagenhauf. January 11th, 1926. (267,653.)

1,107. "Electrical signalling or remote control systems." General Electric Co., Ltd., and C. C. Garrard. January 14th, 1926. (267,65a.)

1,647. "Electric motor control systems." British Thomson-Houston Co., Ltd., D. E. Jewitt and C. J. H. Trutch. January 20th, 1926. (267,659.)

2,146. "Electrically-operated indicating devices." E. S. C. Betteley. January 25th, 1926. (267,663.)

2,197. "Electric switches or connections of the plug-in type." J. B. Tucker. January 26th, 1926. (267,664.)

3,138. "Asynchronous electric motors." English Electric Co., Ltd., R. L. Cleaver and R. D. Ball. February 3rd, 1926. (Cognate application 19,491/26.) (267,670.)

3,490. "Electric switches." A. E. Mason. February 8th, 1926. (267,674.)

5,792. "Rectifying and smoothing or ripple-elimination of alternating currents." W. Diggle. March 2nd, 1926. (267,701.)

5,973. "Electric switches or circuit-breakers." Electrical Improvements, Ltd., R. W. Gregory and L. C. Grant. March 3rd, 1926. (267,703.)

6,016. "Heating of metals by electricity." D. F. Campbell. March 3rd, 1926. (267,704.)

6,257. "Telephone sets." Sterling Telephone & Electric Co., Ltd., N. Blades and L. V. Marks. March 5th, 1926. (267,705.)

6,368. "Electric boiling rings, electric radiators, and the like." F. J. Wineberg. March 8th, 1926. (267,706.)

8,601. "Electric heaters, particularly for cooking purposes." S. D. White and T. H. Leak. March 23rd, 1926. (267,716.)

11,009. "Direct-current dynamos." T. A. Lemaster. April 26th, 1926. (267,735.)

11,341. "Train control systems." T. E. Clark and J. E. Clark. April 29th, 1926. (267,738.)

11,559. "Apparatus for transmitting or reproducing sound." S. G. Brown and S. G. Brown, Ltd. May 1st, 1926. (267,742.)

11,682. "Automatic electric temperature responsive alarms." E. W. Meyer. May 3rd, 1926. (267,744.)

12,437. "Electric motor control systems." British Thomson-Houston Co., Ltd. May 16th, 1925. (252,189.)

12,719. "Contacts for electric switches, in particular starters for electric motors and the like." K. Muller and Celos Anlasserbau Ges. May 18th, 1926. (267,752.)

13,219. "Electric control systems." British Thomson-Houston Co., Ltd. May 25th, 1925. (252,408.)

15,638. "Arrangement for producing a neutral tapping-point in three-phase networks for connecting up neutral point choking coils." Akt. Ges. Brown, Boveri et Cie. June 20th, 1925. (253,944.)

16,220. "Fault-indicating devices for transformers." Allmanna Svenska Elektriska Aktiebolaget. July 27th, 1925. (255,836.)

18,233. "Electrical apparatus for the testing of internal-combustion and other engines." F. W. Highfield and Highfield Electrical Co., Ltd. July 21st, 1926. (267,777.)

18,234. "Electrical apparatus for the testing of internal-combustion and other engines." F. W. Highfield and Highfield Electrical Co., Ltd. July 21st, 1926. (267,778.)

18,235. "Electrical apparatus for testing motor vehicle and other mechanical power-transmission mechanisms." F. W. Highfield and Highfield Electrical Co., Ltd. July 21st, 1926. (267,779.)

18,749. "Contact plugs for electrical connections." C. R. Forth. July 27th, 1925. (255,910.)

19,605. "Loud speakers for wireless receiving apparatus." F. M. T. Reilly. January 6th, 1926. (Divided application on 267,647.) (267,790.)

19,835. "Electric switches for liquid-fuel burners." E. C. R. Marks (Williams Oil O-Matic Heating Corporation). August 11th, 1926. (267,793.)

20,713. "Dirigible headlights for motor vehicles." S. R. Densem and J. Hart. August 23rd, 1926. (267,799.)

21,053. "Contacts for electric switches, fuses, and the like." Callender's Cable & Construction Co., Ltd., and J. F. Watson. August 26th, 1926. (267,800.)

21,055. "Variable air electric condensers." Igranic Electric Co., Ltd. August 29th, 1925. (257,617.)

21,553. "Electric railway signalling devices." F. Matuscheck. September 1st, 1926. (267,805.)

22,347. "Protective means for electric furnaces." British Thomson-Houston Co., Ltd. September 10th, 1925. (258,277.)

22,639. "Electric slowly-acting relays for use with automatic circuit-breakers for protecting electric circuits." Siemens-Schuckertwerke Ges. September 15th, 1925. (258,588.)

22,764. "Current transformers." Metropolitan-Vickers Electrical Co., Ltd. October 1st, 1925. (259,198.)

24,059. "Means for reproducing position." British Thomson-Houston Co., Ltd. September 29th, 1925. (259,215.)

24,840. "Copper conductors for electric power cables." Felten & Guilleaume Carlswerk Akt. Ges. April 12th, 1925. (267,822.)

25,943. "Dynamo-electric machines." International General Electric Co., Inc. October 16th, 1925. (259,996.)

26,101. "Aerials for the transmission and reception of electro-magnetic waves." E. Geles. October 19th, 1925. (260,005.)

26,450. "Multiplex telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. October 22nd, 1926. (267,830.)

28,769. "Gaseous electric conduction devices." Raytheon Manufacturing Co. December 21st, 1925. (263,109.)

29,829. "Thermionic valves." M.-O. Valve Co., Ltd., G. C. Marris, and M. Thompson. November 25th, 1926. (267,849.)

30,426. "Electric current collectors." British Thomson-Houston Co., Ltd. December 1st, 1926. (Convention date not granted.) (262,430.)

31,250. "Electric furnaces." International General Electric Co., Inc. December 9th, 1925. (262,796.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 6th :—

Columbus. No. 477,580. Class 6. Electric floor polishing machines and vacuum-cleaning machines.—Columbus Suction Polisher Co., Ltd., 4, Broad Street Buildings, E.C.2.

K.G. (lettering and design). No. 475,841. Class 8. Electric batteries and apparatus and parts thereof for use in radio-telegraphy and telephony.—K.G. Battery Co., 16-18, Moult Street, Cross Street, Manchester.

Desmo. No. 477,415. All goods in Class 8.—Desmo, Ltd., 31, Stafford Street, Birmingham.

Supervox. No. 476,238. All goods in Class 9.—Société Française Radio-Electrique, 79, Boulevard Haussmann, Paris. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2.)

Pipon. No. 475,322. Class 13. Bulb and electric horns and similar audible warning devices.—C. Hasler & Son, Ltd., 94, Bridge Street West, Birmingham.

Lissen. No. 477,380. Class 13. Sparking plugs and electric irons.—Lissen, Ltd., Friar's Lane, Richmond, S.W.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BILLINGHAM (Stockton-on-Tees).—Houses (233), for the Synthetic Ammonia and Nitrates, Ltd.

BILSTON (Wolverhampton).—Girls' high school, Wellington Road, for the governors; the clerk.

BIRMINGHAM.—Central fire station, junction of New Corporation Street and Aston Street (cost, including demolition of existing buildings and providing fresh offices for the Corporation Weights and Measures Department, &c., £200,000); city engineer and surveyor. Juvenile Court, Steelhouse Lane; Watch Committee. Treatment centre, General Hospital; city engineer. Extensions, Witton Babies' Hospital; city engineer. Hall, Alum Rock Road; Salvation Army.

BOLTON.—Kinema, Churchgate; G. E. Tong and F. Holt. Palais de Danse, Bridge Street; F. W. Meredith. Offices and transformer house, Moss Lane Colliery; S. Scowcroft & Sons, Ltd. Extensions, Temple Bleachworks; T. Cross & Co., Ltd. Extensions, Settle Street; Ocean Spinning Co., Ltd. 40 houses, Castlewood Square; Leigh Bros., Ltd.

BRIERLEY HILL (Staffs.).—Housing scheme (68), for the U.D.C.; John Yorke, surveyor.

BRIGHTON.—Zoological gardens, London-Brighton Road (£50,000); G. Bruce Chapman, proprietor of Barnet Zoo.

BROADSTAIRS.—Houses (36), for the U.D.C.; Gilbert Bros., builders, Bradstow Way.

BROMLEY (Kent).—School, Bromley Common, and two practical instruction centres, for the borough E.C.; Director of Education.

CAMBERLEY (Surrey).—Church, for the trustees of the Congregational Church; Rev. C. H. Pugh, B.A., pastor.

CHESTERFIELD.—Additional 50 houses, St. Augustine's estate, for the T.C.; borough surveyor.

CHESTER-LE-STREET.—Bazaar premises, for F. W. Woolworth & Co., Ltd., Kingsway, London.

CREWE.—Extensions to Memorial Hospital (£15,000), for the governors; P. Temperley, hon. sec.

DUKINFIELD.—Additional 105 houses, Clarendon Fields site, for the T.C.: borough surveyor.

DURHAM.—Additional housing schemes (108), Sherburn and Ludworth, for the R.D.C.; surveyor.

GLASGOW.—Factory in Kirkintilloch Road, for Blackie and Sons, Ltd., printers and publishers; the manager. Conversion of mansion house into mental institution (lighting and heating); clerk, Parish Council. Cinema, Summerfield Street, for Strathclyde Cinema Co.; the secretary. Factory in William Street, for James Templeton and Co.; the manager. Hall in Partick, for Salvation Army; Army Headquarters. 500 houses and 12 shops at Bilsland Drive, for Corporation; city architect.

GRAYS.—Girls' and boys' schools, with hostel and laundry (£84,000), for the governors of Palmer's schools; J. Stuart, county architect, Springfield Old Court, Chelmsford.

GUILDFORD.—Factory, The Bars; Guildford Glass Works.

GUISELEY.—School; Education Department, County Hall, Wakefield.

HARTSHORNE AND SEALS.—Housing scheme (60), for the R.D.C.; A. C. Clarke, architect, 73, Wood Street, Church Gresley, Burton-on-Trent.

HOLMFIRTH.—32 houses, Woodlands, Thongsbridge; P. Williams, clerk to the Council.

HULL.—Admission hospital and nurses' home, Mental Hospital; city engineer. Central library extension; city architect. 60 houses, Loveridge Avenue; W. H. Loveridge.

INCE.—Central schools, Rose Bridge, for Lancs. E.C. (£40,591); education architect, Preston.

IRISH FREE STATE (Cork).—200 houses; City Commissioner. Hospitals at Macroom, Bandon, Kanturk, Clonakilty, Bantry, and Skibbereen, including electric lighting (£100,000); South Cork Board of Public Assistance.

(Killarney).—Technical school; Kerry County Technical Committee.

KEMPSTON.—Extensions to works, for Cryselco, Ltd.

LANCASTER.—72 houses, for Corporation; F. Moore and Co., Morecambe.

LEICESTER.—Building for artificial light treatment, Groby Road Sanatorium; Symington & Prince, architects, for Corporation.

LEYLAND (Lancs.).—Additional 60 houses for the U.D.C.; surveyor.

LONDON (Becontree, E.).—Two additional schools, London County Council housing estate, for Essex C.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.

(Mile End, E.).—Elementary school, Cephas Street; A. E. Symes, for L.C.C. Education Committee.

(Stepney, E.).—Roman Catholic central school, Lucas Street; T. R. Ring.

(E.C.).—Buildings for *News of the World*, Bouverie Street and Whitefriars Street; A. A. H. Scott.

(Marylebone, N.W.).—Central library, Marylebone Road (£50,000); borough engineer. Reconstruction of premises, Oxford Street, Henrietta Street, Vere Street, and Marylebone Lane; Marshall & Snelgrove.

(Bermondsey, S.E.).—School for tuberculous children, Fort Road; L.C.C. architect.

(Eltham, S.E.).—Roman Catholic church, Well Hall housing estate; Rev. Abbot White.

(Aldwych, W.C.).—Offices, for the Indian Government (£300,000).

(Piccadilly, W.).—Theatre, corner of Denman and Sherwood Streets, for E. Laurillard; Messrs. B. Crewe and E. A. Stone, architects.

MARKET HARBOROUGH.—36 houses; U.D.C. surveyor.

MIDDLESBROUGH.—Constantine College (£65,894), for the borough E.C.; Stephen Easten, Ltd., builders, Newcastle-on-Tyne.

MOORTHORPE (South Elmsall).—Roman Catholic church and presbytery (£8,000); Holton & Fox, architects, Dewsbury.

NEWCASTLE.—Housing scheme on 432 acres, near city boundary; city engineer. Pavilion, Walkergate Hospital; city engineer. Sheds at Quayside; Wright, Anderson and Co., Ltd.

NEW MALDEN.—Extensions to mental hospital (£10,000), for Middlesex C.C.; W. H. Gaze & Sons, builders, Kingston-on-Thames.

NORTHAMPTON.—Improvements, Harboro Road hospital; borough engineer. Works extensions, Kingsthorpe Hollow; Northampton Foundry Co. Timber mill and store, Old Towcester Road; E. T. Trenery & Sons.

OXFORD.—Extensions, Merton Street; Corpus Christi College Wardens.

PLYMOUTH.—Education offices, Cobourg Street; Education Committee. Electric lighting improvements, Museum and Art Galleries; borough electrical engineer. Extensions, Municipal Offices, Guildhall; borough engineer. 52 houses, Mount Gold; Astor Housing Trust. Additions, depôt, Manor Street; Dunlop Rubber Co., Ltd. Motor showrooms, stores, &c., Stuart Road; W. S. Reed.

RAMSGATE.—Dance hall, &c., with electrical equipment, Harbour station site; William Thompson, 2, Burleigh Mansions, Charing Cross Road, London.

REIGATE.—Printing works, off Cavendish Road, Redhill, for the Surrey Fine Art Press. Additional housing scheme (44), for the T.C.; borough surveyor.

ROTHERHAM.—Additional housing schemes (66), Dalton and Bramley, for the R.D.C.; surveyor.

ST. HELENS.—Secondary school, for the borough E.C.; Biram & Fletcher, architects, George Street.

SEDGEFIELD.—Additional 50 houses, for the R.D.C.; surveyor.

SHERBURN (Co. Durham).—Extensions to hospital; Joseph Potts & Son, architects, 57, John Street, Sunderland.

SOUTHPORT.—Houses (52), for the T.C.; Leonard Livesey and Peter Sutton, builders.

STOCKTON-ON-TEES.—Shops, Leven Road, Norton, for the Co-operative Society; secretary.

UPMINSTER.—School (£11,965), for Essex E.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.

WAKEFIELD.—County offices, Wood Street; clerk of the County Council.

YORK.—Warehouse, Wiggington Road; Rowntree & Co., Ltd.